



USAID | **SOMALIA**
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ASSESSMENT

Environmental and Natural Resource Management Assessment

April 2014

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COVER PHOTO

Laas Gaal, Somalia, 2013, by Bryan Shipp

ENVIRONMENTAL AND NATURAL RESOURCE MANAGEMENT ASSESSMENT

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This report was prepared by Farhiya Ismail Dullo (Team Lead), John Michael Kramer and Dekow Shallow Mohamed. The authors' views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

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ACRONYMS

ADESO	African Development Solutions
ADS	Automated Directives System
AMISOM	African Mission in Somalia
CARE	Cooperative for Assistance and Relief Everywhere
CBD	Central Business District (Mogadishu)
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
ELMT	Enhanced Livelihoods in the Mandera Triangle
ELSE	Enhanced Livelihoods in Southern Ethiopia
EMMP	Environmental mitigation and monitoring plan
ENRM	Environmental and natural resource management
ERC	Environmental review checklist
EU	European Union
FAO	UN Food and Agriculture Organization
GRIDMAP	Groundwater Resources Investigation for Drought Mitigation in Africa Programme
HADMA	Humanitarian Affairs and Disaster Management Agency of Puntland
HUWSUP	Hargeisa Urban Water Supply Upgrading Project
IGA	Income-generating activity
IICPSD	UNDP Istanbul International Center for Private Sector in Development
IOC	Intergovernmental Oceanographic Commission
IRENA	International Renewable Energy Agency
IRI	International Republican Institute
KII	Key informant interview
LPG	Liquefied petroleum gas
MDG	Millennium Development Goal
MEPS	Monitoring and Evaluation Program for Somalia
NAPA	National Adaptation Program of Action
NBSAP	National Biodiversity Strategy and Action Plan

NERAD	National Environment Research and Disaster Preparedness and Management Authority of Somaliland
NGO	Non-governmental organization
NRM	Natural resources management
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
PPP	Public-private partnership
PROSCAL	UN Joint Program for Sustainable Charcoal Production and Alternative Livelihoods
PSAWEN	Puntland State Authority for Water, Energy and Natural resources
RELPA	Regional Enhanced Livelihoods in Pastoral Areas
SECIL	Sustainable Employment Creation and Improved Livelihoods for Vulnerable Urban Communities in Mogadishu
SOW	Scope of work
SWALIM	Somalia Water and Land Information Management
SWD	Somalia Water Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	UN Framework Convention on Climate Change
UNODC	UN Office on Drugs and Crime
UNSOM	United Nations Assistance Mission in Somalia
USAID	U.S. Agency for International Development

EXECUTIVE SUMMARY

Somalia's population is estimated at 7.7 million with an annual growth rate of 2.9 percent (ACP-EC, n.d.). The majority of the population lives in rural areas, urban communities make up approximately 37 percent of the total population (CIA World Factbook, n.d.). Pastoralism accounts for the livelihood of over 65 percent of the population (UN OCHA Somalia, 2006); livestock and livestock products contribute to over 40 percent of GDP and more than 50 percent of export earnings (African Development Bank, 2013). This sector is therefore the mainstay of the economy and is reliant on the good and services provided by rangeland eco-systems. In addition to livestock, the country exports Frankincense and Myrrh (FAO, 1995), both of which are also dependent on the health of terrestrial ecosystems. The country is thus heavily dependent on natural resources for livelihoods and economic growth.

The purpose of this Environmental and Natural Resources Management Assessment is to identify significant environmental issues and challenges affecting Somalia and to highlight activities or types of interventions which USAID might support based on the findings of the assessment. The assessment provides the required context and analysis to help USAID determine how to contribute best to reducing environmental degradation, taking into consideration the constraints of time and resources as well as overall strategic considerations.

The assessment team applied a mixed-methods data collection approach using primary and secondary data. Data was analyzed using content analysis¹. The assessment team collected secondary data through a fairly extensive review of relevant documents on natural resources and related environmental issues from government ministries, donor organizations, UN bodies, civil society and research institutions. The review included documents by the above-mentioned organizations on policy and legislation as well as their programs and projects (completed and ongoing) for expert opinions on environment- and natural resources-related issues in the country. The assessment team collected primary data through a total of 70 open-ended key informant interviews (KII) of government, local and international organization staff and members of professional bodies involved in environment and natural resources issues in Somalia. The assessment was descriptive in approach and used purposive and snowball sampling techniques for interviewee selection. To supplement the data collected and to cross-check the accuracy of the information collected during the KIIs and desk review, the team conducted site visits and interactive field observations.

The subject of environmental and natural resources management is vast, and so the team first set out to map out all existing environmental programs operating in Somalia today. The mapping followed the broad categories or thematic areas below.

¹ Content analysis: This is a qualitative data analysis method that is particularly suited to the assessment as it groups data by key words or categories. The unit of analysis will be the key environmental issues as identified by primary and secondary sources of data.

Thematic Area	Agency (Implementing or funding)
Resource mapping and research	FAO, UNDP, UNEP, UNESCO, EU
Environmental services provision– Water resource management	EU, UN HABITAT, CARE, Terre Solidali, FAO
Land reclamation	EU, ADESO
Environmental services provision– Solid waste management	EU, UN HABITAT
Environmental governance	EU, CARE, UNDP, FAO
Energy	UNDP, EU, ADESO

Viewed against the scale and the far-reaching impact of the environmental threats reported, one clear theme recurrently came to the forefront: Current interventions in Somalia are not keeping pace with the rate of degradation. All agencies interviewed indicated that needs for intervention far exceeded any allocated resources for such interventions. Current needs and gaps are in fact so vast that from a geographical and funding point of view, there are no identifiable overlaps in funding or existing synergies between existing programs.

For the purposes of this report, however, the team identified three key environmental issues based on thematic analysis of grey literature and in-depth responses to the KIIs. These are (i) land degradation, (ii) inadequate access to safe water and (iii) urban waste and pollution. These issues emerged as the most pressing environmental issues in Somalia today due to their negative impact on the quality and quantity of goods and services derived from Somalia’s natural-resource base and the resultant decline in livelihoods and well-being. Relationships between and within these issues—their causes and drivers—are nonetheless neither simple nor linear. Drivers of environmental degradation (such as conflict and poverty) often serve as both its causes and consequences. Impacts from one source of degradation can also often serve to reinforce other forms of degradation (e.g., land degradation contributes to a decrease in access to safe water through its effect on the infiltration capacity of soil).

Within the context of evidence-based findings, the following key recommendations may help to guide future areas of intervention in Somalia. **Some recommendations are quick-impact, others are more comprehensive.**

Quick-impact interventions:

1. **Urban waste disposal systems:** Endpoint disposal of liquid, hospital and slaughterhouse waste is a clear and imminent threat to the health of urban populations. As the Mission supports the construction of clinics and marketplace slaughterhouses, the assessment team recommends that USAID Somalia also fund the construction of central disposal facilities for those facilities. Possible structures include bio-digesters for slaughterhouse waste and high-voltage incinerators for medical waste.
2. **Mapping ground water resources:** Priority areas of intervention should also include the water supply sector by mapping the country’s reservoirs to address sector limitations. The assessment team recommends that USAID Somalia focus on water-stressed areas in Somaliland (as identified by the Ministry of Water) and on ground water aquifers in the South that depend on flows from Ethiopia (that area being particularly important for the sustainable management of trans-boundary water resources).

Comprehensive interventions:

1. **Sustainable land use:** The assessment team recommends that USAID Somalia consider its interventions to focus on the physical recovery of forested areas and rangelands in Somalia, with activities focusing more specifically on agro-forestry for southern Somalia and soil erosion control for northern Somalia. Sustainable land use activities should also prioritize initiatives which promote energy efficiency and alternative energy sources.
2. **Environmental services provision:**
 - a. **Water harvesting for surface water points:** Given the country's reliance on surface water sources, it is important to support a service provision that is well-planned, sustainable and protected from contamination. There is a variety of water harvesting systems; some feed into concrete cisterns or water pans and water can be used for domestic, animal or drip irrigation systems. This could be linked to rangeland rehabilitation with check dams diverting water into pans or cisterns.
 - b. **Social marketing and behavior change:** This area of intervention relates to Community-Led Total Sanitation, where activities are designed to engender awareness on the importance of proper disposal of solid and liquid waste. The aim here is increased knowledge and behavior change, particularly on separation of waste, halting burning of plastics and disposal of waste in and around water sources.
3. **Environmental governance:** The Mission has already made some long-term investments in governance over its long history in Somalia, building a comparative advantage in this area. USAID's ongoing support to local governance will hence serve as an essential complement to the following activities:
 - a. **Land tenure and resource rights:** The aim of potential USAID-funded activities here should be to support the development of land tenure and resource rights systems that encourage long-term investment and sustainable management of land resources.
 - b. **Capacity development of government agencies and local governance structures:** To address gaps in natural resources management (NRM), the assessment team recommends providing support to an NRM capacity building program that would build on the capacity of existing village management structures in sustainable resource management. Capacity building should also target local government and relevant line ministries, strengthening formal and informal structures as resource management depends on the involvement of all stakeholders.
 - c. **Capacity development of the Federal Government:** The assessment team recommends targeted capacity development that support government in achieving specific activities related to the country's participation in regional and international resource management, including in the following specific subject areas:
 - Trans-boundary issues;
 - Training resource managers;
 - Negotiating a temporary ban by Gulf States on charcoal imports from Somalia.

PART I: INTRODUCTION

A) BACKGROUND

This assessment was conducted under the guidance of USAID ADS 203 and in accordance with the 2011 USAID Evaluation Policy¹, ensuring that the findings, conclusions and recommendations adhere to USAID's rigorous standards for field data collection and analysis. The assessment is supported by evidence-based findings from multiple data sources and acts as a sound basis for analysis that leads to **actionable** recommendations relevant to USAID's future programming in Somalia. It should be noted, however, that neither ADS 203 nor the Evaluation Policy have prescriptive guidelines on the design and conduct of USAID program or portfolio **assessments**, and are, rather, more appropriate guiding tools for evaluation design, implementation and management.

The purpose of the assessment was to identify the most significant environmental issues and challenges affecting Somalia and highlight those that USAID might address based on the findings of the assessment. Environmental issues in Somalia are diverse in terms of sectors and regions; this, coupled with the fact that the country has been unstable for decades, has meant that environmental issues have not received due attention. The assessment provides the required context and analysis to help USAID determine how to contribute to reducing environmental degradation within natural constraints of time, resources and strategic considerations.

B) METHODOLOGY

The assessment team deployed a mixed-method data collection approach that included a comprehensive desk review; key informant interviews (KIIs); a review of USAID environmental verifications reports; and site observations. This collection approach allowed for the corroboration of the findings through data **triangulation**. The team understands triangulation as a method used during the evaluation process to check and establish validity of conclusions by analyzing the responses to evaluation questions from multiple perspectives, such as when conducting the multiple data collection methods. Triangulation of data enabled the team to ensure the validity of its conclusions, i.e. that the findings of assessment were **true** (accurately reflecting the situation) and **certain** (supported by the evidence).

The data collection techniques were used to address the following assessment questions of interest to USAID:

- **Which environmental issues have the most negative effects on Somalia?**
- **What are the causes of these identified issues? What are the interrelationships between the environmental problems facing Somalia and the various drivers of environmental degradation?**

¹The evaluation will meet or exceed the USAID 2011 Evaluation Policy, USAID's Performance Monitoring & Evaluation TIPS: Data Quality Standards, relevant chapters of the USAID Automated Directives System (ADS), the performance standards outlined in the RFTOP Task Order SOW, as well as with the Federal Policy for the Protection of Human Subjects or "Common Rule" [ADS Chapter 200 - <http://www.usaid.gov/policy/ads/200/200mbe.pdf>].

- Which issues seem to be the most damaging to the livelihood of Somalis?
- Which issues are cross-regional? Which are region-specific?
- What regulatory frameworks exist and which ones are missing to address the identified issues?
- How does Somalia manage the trade-off between protecting and nurturing the environment on the one hand, and fostering human and economic development on the other hand?

More specifically, the assessment sought to answer the following questions designed to allow the team to compare and contrast, and ultimately archive, data and KII responses:

- What does the organization do?
- Where do they get their funding?
- What is their geographic spread?
- How are their activities relevant to ENRM in Somalia?
- Who else is working in Somalia to address these issues?

Desk review: The desk review consisted of a comprehensive review of civil society and non-government organization environmental reports, sector studies, research, project evaluations, best practice guidelines and government policy documents to inform the team's assessment. This initial phase also informed the scope and content of the KII instruments (see Annexes for detailed methodology including work plan and KII tool).

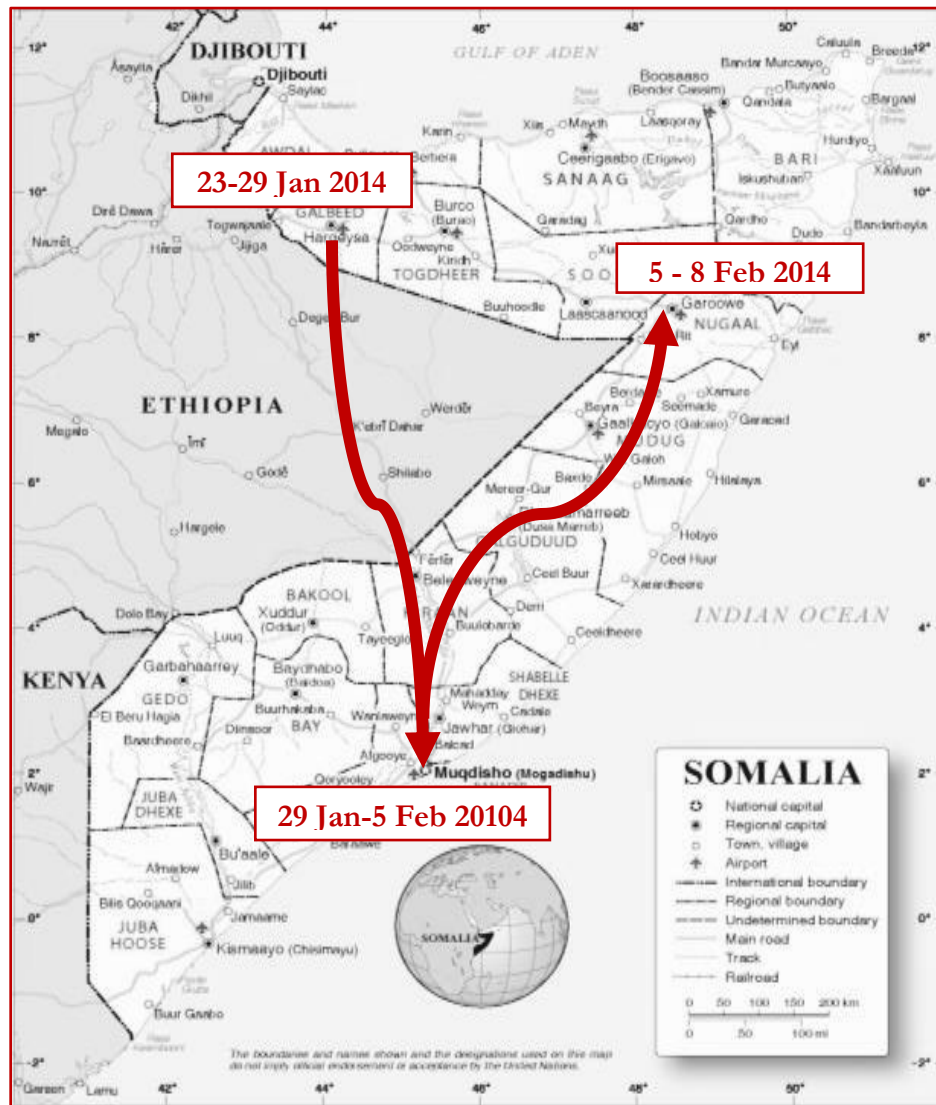
KIIs: The team conducted 70 purposive KIIs, i.e. those with pre-selected respondents including representatives of local and regional governments, line ministries, representatives from civil society organizations in Somalia, UNDP, UNESCO, ADESO, UN HABITAT, CARE, the EU Mission to Somalia and FAO Somalia. A full list of respondents is included in the Annexes to this report. The team developed the KII instrument to reflect directly the key environmental issues identified in the SOW and to include addressing key questions of interest to the best degree possible.

Where feasible, and to inform the data analysis and the triangulation of findings from the desk review and the KIIs, the team compared and contrasted these findings with data derived from direct observation and, where relevant, verification reports². This allowed the team to corroborate and/or refute findings against those identified by other data collection methods.

Verifications reports review: the assessment team reviewed the first round of third party environmental verification reports (only 5 verifications), as well as the EMMPs of the largest USAID activities in Somalia (3 activities). These documents provided some additional secondary data on potential negative environmental impacts and the status of control and mitigation activities.

² Due to the limited duration of field work, the assessment team made the decision to focus on areas of concern identified by respondents rather than visits to project sites to assess the status of control and mitigation activities.

Figure 1: Coverage and Duration of Field Work. Source: MEPS, 2014



Site visits/observation: To supplement data collected and cross-check the accuracy of the information derived from the KIIs and desk review, the team conducted several site visits and interactive field observations. Site visits included:

- *Hargeisa:*
 - Dump sites for liquid and solid waste,
 - Water infrastructure project at Haraf,
 - Main slaughterhouse,
 - Hargeisa Group Hospital;

- *Mogadishu:*
 - Limestone quarry,
 - Liquid waste dump site;
- *Garowe:*
 - Dump site for solid waste.

The team then employed two data analysis methods to identify key findings from the collected data, draw conclusions and make recommendations. Content analysis allowed the team to review the data derived from the KIIs, desk review and verifications reports to identify and highlight notable examples of the key issues and their attendant impacts, etc. Gap analyses by the team examined which activities were most notably deficient or required urgent future support and/or donor or host-government intervention.

PART II: CONTEXT AND KEY ISSUES

A) SOMALI CONTEXT AND KEY FACTORS

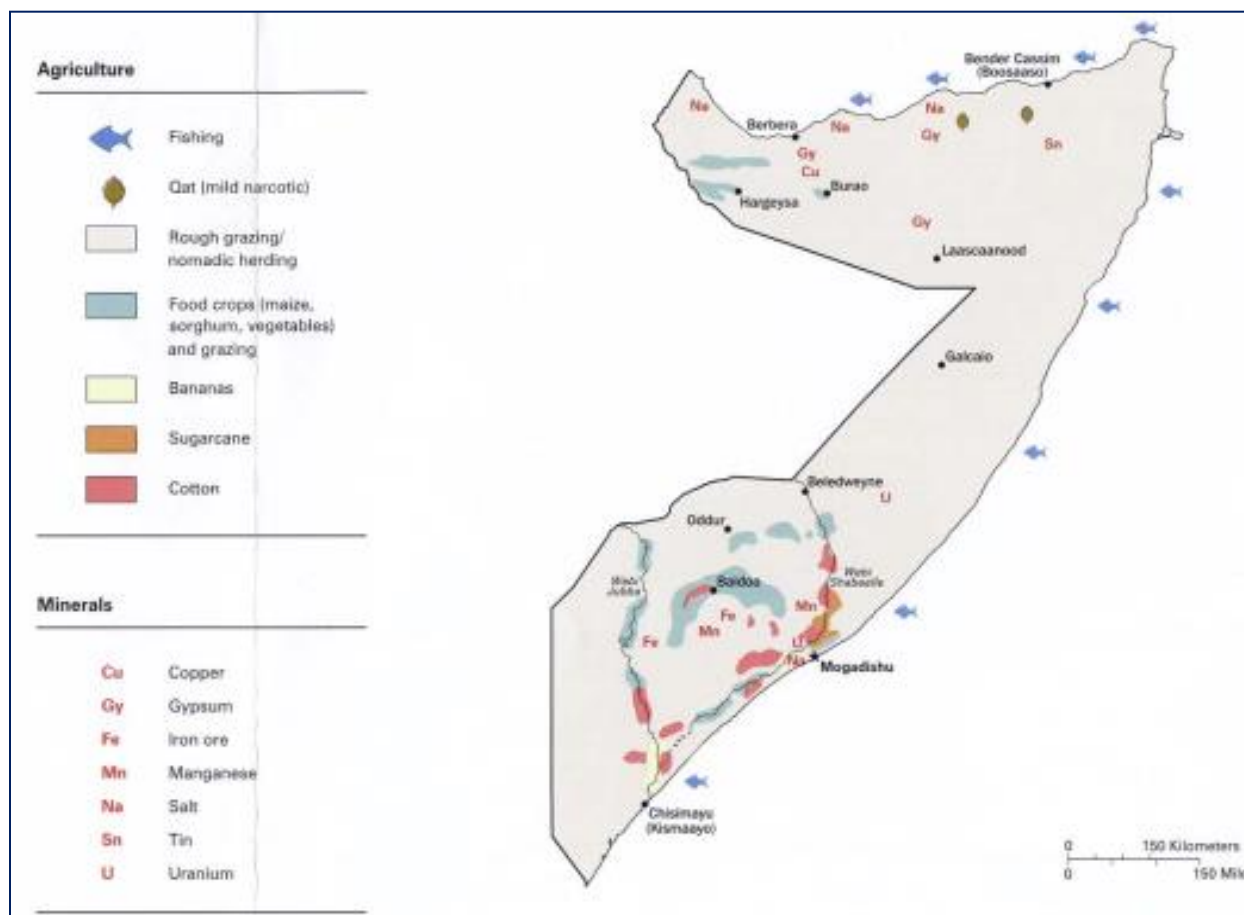
Natural resources form the basis of rural livelihoods in Somalia, with over 65% of the population living in rural areas (UN OCHA Somalia, 2006). Pastoralism is the most prevalent land use in Somalia; livestock and livestock products contribute to 40% of GDP and over 50% of export earnings (African Development Bank, 2013; Government of the Federal Republic of Somalia and UN Somalia, 2013). Livestock is therefore the mainstay of the economy and is almost completely reliant on rain-fed fodder. In addition to livestock, the country's main exports are bananas from the South (Farah, Hussein and Lind, 2002) and Frankincense and Myrrh from forested areas, particularly in the North (FAO, 1995). All of these products are dependent on water availability, making access to water a persistent environmental problem for most of Somalia. In recent years, limited rainfall and lack of water availability has also contributed to an increase in localized conflicts over access and control over this resource (Farah, Hussein and Lind, 2002), underscoring the importance of sustainable management structures.

Natural resource management in Somalia draws from the traditional, communal systems (*Xeer*) and the government structures that have their roots in the colonial and pre-war legislation (Gundel, 2006). Pre-colonial management systems maintained a system of land rights based on traditional claims, with access being negotiated between clans (Farah, Hussein and Lind, 2002). Traditional claims clearly established clan-based territorial rights over wet and dry pasture, access to market routes and water points (Cassanelli, 1986). Colonial and post-independence management systems co-opted this system of land rights; going a step further to create buffer zones between clans and grazing blocks to reduce inter clan conflict (Farah, Hussein and Lind, 2002).

The civil war brought a complete breakdown of these structures, setting the stage for unchecked exploitation of the country's natural-resource base and the gradual loss of *cilmi curaaf*, the oral store of weather and plant lore that informed sustainable exploitation of rangeland resources (Galaal, 1968, quoted in Cassanelli, 1986).

The federal government and the governments of Somaliland and Puntland have since developed structures and policies to address the damage caused by unsustainable exploitation of natural resources. Unfortunately, gaps in reach and capacity have reduced their effectiveness, leaving grassroots natural resource management to individual communities with grave consequences for the resilience of ecosystems and the quality of services they provide to rural communities.

Figure 2: Land Use and Natural Resources in Somalia. Source: Central Intelligence Agency, 2002



Key factors leading to environmental degradation include poverty, conflict and socio-economic conditions.

Poverty is both a driver and consequence of environmental degradation in Somalia. Poverty levels in the country are high with over 94% of rural population (98% for nomadic populations) living in multi-dimensional poverty³ (UNDP Somalia, 2012). The resilience of rural households cannot be decoupled from the resilience of ecosystems. High levels of poverty fuels unsustainable exploitation rates and negative coping strategies. This in turn degrades the quality of natural resources and leaves ecosystems and communities vulnerable to shocks and stresses, including extreme weather events associated with climate change (Government of the Federal Republic of Somalia and UN Somalia, 2013).

Conflict: The link between conflict and natural resources in Somalia is well established. Access to rangeland resources and control over land has fueled localized and large-scale conflicts in the

³ UNDP defines this as “the number of people with a weighted deprivation score of 33 percent or more”.

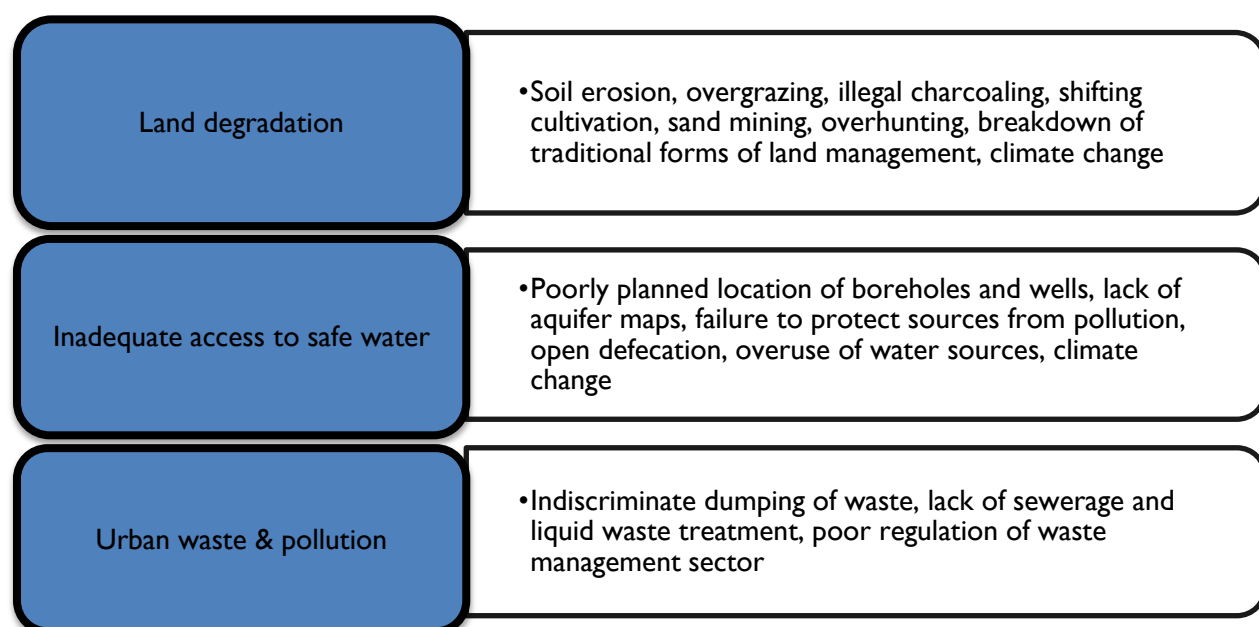
country (Farah, Hussein and Lind, 2002). A diminishing natural-resource base and the unregulated exploitation of these resources contribute to further conflict over access. Left unchecked, environmental degradation and conflict reinforce each other in a vicious, self-perpetuating cycle that requires powerful and sustained intervention to slow and eventually reverse.

Socio-economic conditions: Drivers of environmental degradation also include socio-economic sectors that fulfill human needs (U.S. EPA, n.d.) or activities or processes that intend to enhance human welfare (Cooper, 2012). Key socio-economic sectors in Somalia with activities and processes that are directly linked to the causes of environmental degradation include livestock, utilities—energy, drinking water supply and waste management systems.

B) KEY ENVIRONMENTAL ISSUES

The assessment team identified three environmental issues through thematic analysis of grey literature and responses to the key informant interviews. These are land degradation, inadequate access to safe water and urban waste and pollution. These issues emerged as the most pressing environmental issues in Somalia today because of their negative impact on the quality and quantity of goods and services derived from Somalia’s natural-resource base and the resultant decline in livelihoods and well-being. The relationship between these issues, their causes and drivers is not a simple or a linear one; there are feedback loops with drivers such as conflict and poverty serving as both cause and consequence of environmental degradation. Impacts from one problem can also serve to reinforce another; for instance, land degradation contributes to a decrease in access to safe water through its effects on the infiltration capacity of soil. Figure 2 provides a summary of the causes and drivers.

Figure 3: Key Environmental Issues: Causes and drivers. Source: Authors, 2014



I. Land Degradation

Land degradation is defined as the long-term loss of ecosystem function and productivity caused by disturbances from which the land cannot recover unaided. The assessment found two predominant⁴ types of land degradation in Somalia - physical⁵ and biological (Omuto, Vargas and Alim et al., 2009). See Table 1 for a general conceptual framework of the relationship between land degradation and its causes.

Table 1: General Conceptual Framework—Land Degradation. Source: Authors, 2014

LAND DEGRADATION TYPES AND CAUSES		
Land degradation type	Direct causes	Indirect causes
<u>Physical</u>		
Water erosion	Overgrazing	Lack of appropriate knowledge and skills
Wind erosion	Creation of dirt roads across grazing lands	Short-term planning horizon
Compaction	Topography of grazing lands	Lawlessness
Surface sealing and crusting	Improper farming techniques	Lack of functional NRM structures
		Weak tenure and resource access rights
<u>Biological</u>		
Loss of vegetative cover	Increased climate variability	Climate change
Loss of biodiversity	Wood harvesting	Increased demand for resources
Invasion of nuisance species	Shifting cultivation	Lack of access to capital
Loss of habitat		High reproductive rates
<u>Chemical</u>		
Salinization	Poor drainage	Collapse of flood control systems on perennial water courses
Water logging		

The literature review, interviews and field observations are in clear agreement regarding the salient environmental reality of Somalia: Land degradation is severe and, in most places, getting worse (see Annexes for a map of degraded areas).

a. Physical Land Degradation

Physical degradation accounts for 36.6% of the total area degraded in Somalia and over half of the affected rangelands in the north (53.2% of the total area degraded in Somaliland) (Omuto, Vargas and Alim et al., 2009). Physical degradation is more prevalent in the North (Somaliland and Puntland) than in the South (Omuto, Vargas and Alim et al., 2009). Somaliland and Puntland are more vulnerable to physical degradation as the northern part of Somalia is tilted towards the Gulf of Aden, exacerbating the impact of physical processes associated with land degradation (Abdirahman,

⁴ Omuto, Vargas and Alim et al. (2009) also identify two other types of land degradation, i.e. chemical degradation and urban degradation, but put the prevalence of both combined at less than 1%.

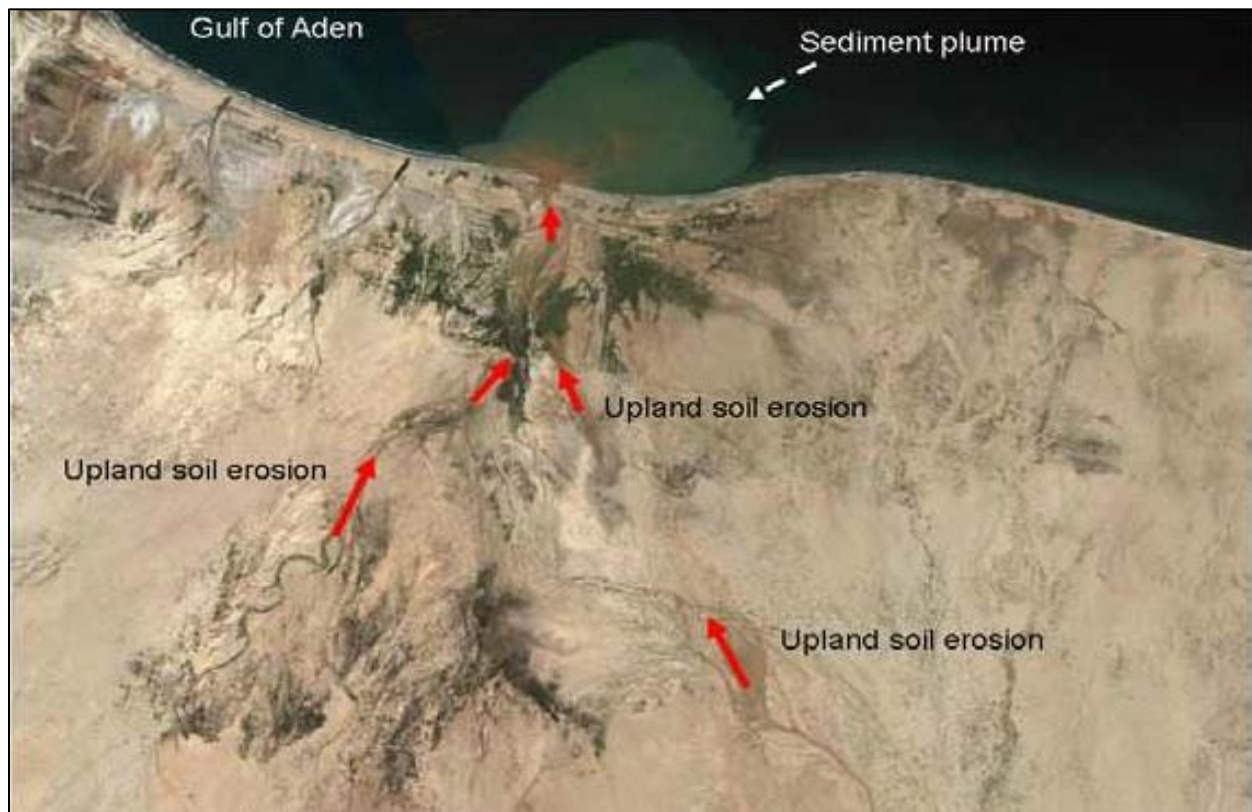
⁵ Included here is the damage caused by soil erosion, aridification and gully formation.

2014). These physical processes include water and wind erosion as well as the impact of traction by livestock and vehicles (Jibril, 2014). As the land surface is largely bare or has minimum ground cover, rainfall—particularly the *Gum* rains (long rains)—removes the top soil, which then washes into the sea. Where the rains are of higher intensity, the lack of natural water breaks (including vegetative ground cover) can increase the intensity of floods, as witnessed recently in Puntland (Hassan, 2013), and cause serious erosion.

Plate 1(a): Soil Erosion Caused by Run-off: Xumbaybas, Puntland (ADESO, 2014)



Plate 1(b): Remote Sensing Image: Loss of Topsoil, Gulf of Aden (Omuto, Vargas and Alim et al., 2009)



Physical degradation is exacerbated by the constant presence of livestock in one place for a period of time and unplanned settlements (IUCN, 2006; UNEP, 2005). This unsustainable land use practice replaced traditional sustainable grazing usage agreements during the prolonged clan-based civil war. Before the civil war, clan-based management systems controlled access to rangeland resources, with movement of livestock following seasonal calendars. Herds would disperse widely during the rainy season to take advantage of seasonal water courses and increased land cover (Cassinelli, 1986). During the dry periods, herds would be restricted to reserves located close to wells with access afforded only to clan members or to those who had negotiated access rights with the clan managing these areas (Cassinelli, 1986). The collapse of those systems during the extended conflict had an immediate effect on the movement of livestock. For herder safety and to prevent theft, large herds were confined to smaller ranges, regardless of season, leading to severe land degradation (Hussein, Igal and Abdullahi et al., 2014).

Penning of livestock in one area for long periods of time contributes to de-vegetation as well as pulverization and compaction of soil; both these physical processes result in increased degradation. De-vegetation reduces wind and water breaks while the compaction of bare soil reduces its capacity to absorb water, not only affecting the fertility of valuable grazing areas but also interfering with the

hydrologic cycle¹. The two processes acting in concert strip the land of the fertile layer of top soil; degrading the quality of surface water and contributing to the decrease in ground water quantity in Somalia.

Plate 2: Gebi Valley, Sanaag (ADESO, 2014)



In the north, the rate of ground cover loss is exacerbated by some members of the local communities' fencing of grazing areas as enclosures for fodder production. This is also occurring on a larger scale as wealthy traders from the Diaspora and Gulf States with livestock commercial interest have cordoned off large tracts of land for commercial fodder production (Abdi and Ibrahim-Buffalo, 2014; Ahmed, 2014). The use of enclosures cuts off access by pastoralists, confining livestock to smaller areas and increasing the intensity of the damage caused by overgrazing and compaction. The creation of commercial grazing plots also has social consequences; this relatively new practice amongst Somali pastoralists has created inter- and intra-clan rangeland resource conflict (Ahmed, 2014). A recent study by CARE Somalia directly linked the exploitation of grazing lands to resource conflicts in Sool and Sanaag (Mahmoud, Omuto and Said, 2012).

An increase in the number of feeder roads and dirt tracks through grazing areas is affecting the flow of run-off and contributing to water erosion. Wealthy livestock owners are able to move their livestock relatively quickly from one place to another using modern transport in search of water and pasture. This has created a network of dirt roads within rangelands that are visible from the air; many of these roads have turned into water channels and gullies. As land degradation is a gradual

¹ See Horton's perceptual model of infiltration processes for contribution of infiltration to ground water flow.

process, what may start as rill erosion² eventually turns into gullies. Water-related physical erosion occurs across Somalia and Somaliland but is most prevalent in Sanaag and Sool regions, where mega gullies are a common feature (Abdi and Ibrahim-Buffalo, 2014).

In northern Somalia, wind erosion becomes the predominant cause of land degradation during the dry seasons. Soil loss due to wind erosion is common along the coastline and south-western areas of Gedo region (Omuto, Vargas and Alim et al., 2009). Average wind speeds in Somalia reach 0.2 to 8.5m/sec and tend to vary per year and between seasons (Muchiri, 2007). Hargeisa has the highest recorded average of 17m/sec in the months of June and July; in the South (past Lower Juba) average wind speed is 8-10 m/sec (Muchiri, 2007). High wind speed coupled with the lack of vegetation cover to serve as windbreaks mean dust devils commonly transport tons of topsoil, further accelerating the degradation of fragile arid ecosystems.

Physical degradation removes the topsoil, which reduces the available forage, affecting the diet of livestock (sheep, goats and camels). Respondents noted the loss in land cover due to both physical and biological degradation is so extreme that it has resulted in dietary changes for camels, which are normally browsers but have been forced to graze (Mohamed and Abikar, 2014).

b. Biological Land Degradation

Biological land degradation in this context refers to loss of vegetation and diversity of plant species. Biological degradation accounts for 37.89% of the damage caused by land degradation (30.48% for Somaliland) (Omuto, Vargas and Alim et al., 2009). The annual rate of deforestation for Somalia (1.03%) is three times that of neighboring Kenya (0.3%) and almost twice the average rate of loss for Africa (0.62%) (FAO, 2009). The assessment team's discussions with government officials and local NGOs revealed that the primary causes of de-vegetation are overgrazing (see preceding section on physical land degradation for a discussion on the effects of overgrazing), shifting cultivation and unregulated charcoaling.

Shifting cultivation has contributed to biological land degradation, particularly in the South. With the region experiencing prolonged conflict and rapid environmental degradation, communities practice transhumant migration as a coping strategy (Farah, Hussein and Lind, 2002). This has exacerbated the rate of land conversion; migrants clear forested areas for cultivation only to abandon them as they flee conflict (Ali and Mohamed, 2014). This constant displacement of persons has weakened any ties communities may feel to the land, reducing incentives towards sustainable land management (Ali and Mohamed, 2014).

Although no study has been conducted on the rate of species loss, most respondents were of the view that a number of palatable local grass species³ have disappeared and that livestock productivity (meat and milk per head) has declined as a result (Hussein, Igal, Abdullahi and Ismail-Gabush, 2014; Awale, 2014; Awaley, 2014). Extreme changes in landscapes such as those caused by overgrazing and deforestation are also ideal conditions for the spread of hardier, invasive species such as *prosopis*.

² Rills are shallow waterways; naturally formed rills in exposed areas are an indication of water erosion.

³ Palatable grass species found in Somalia that are susceptible to overgrazing and land degradation include *Chrysopogon plumulosus*, *Chloris roxburghiana* and *Panicum maximum*.

The spread of invasive species has been linked to the decline in palatable grass species in grazing areas (Awale, 2014; Awaley, 2014).

Indiscriminate charcoal harvesting is currently the single largest contributor to environmental degradation in southern Somalia (Government of the Federal Republic of Somalia and UN Somalia, 2013). The ready availability of the raw materials, the minimal capital needs for charcoaling operations, the breakdown of formal and traditional governance as well as foreign demand have resulted in a rapidly increasing production of charcoal and attendant de-vegetation and desertification (Kirkland, 2011). The UN Monitoring Group on Somalia and Eritrea estimates the total trade volume of charcoal exports from southern Somalia to be in the range of 3.5-4.5 million 25 kg sacks per year representing revenues for Al-Shabaab in excess of \$15 million a year. An estimated 80% of the charcoal is exported to Gulf States (Kirkland, 2011). Some respondents identified China as a recent entrant into the market. In the Gulf States the charcoal is packed in 2 kg bags for retail and is used by consumers for smoking *shisha* (Osman and Mohamed, 2014). The charcoal from Somalia is highly valued because of its slow burn and aromatic smoke.

Without an effective government or rule of law and with large foreign demand and excellent profit margins, there has been little to slow the rapid deforestation of the country short of exhaustion of the resource. The current rate of charcoal removal exceeds the rate of forest growth. Cartels have begun mechanizing their operations (Osman and Mohamed, 2014) and large tracks of land are being cleared to meet the surging demand for charcoal (Federal Government of Somalia and UN Somalia, 2013). In the last 20 years Somalia has lost almost 14% of its forest cover, largely because of unregulated charcoal making (Forest Resource Assessment, 2005; Kirkland, 2011).

Rural households whose land is stripped of trees bear the brunt of the cost. It starts with the loss of access to fuel and fodder for rural families, whose resilience can depend on their herds' ability to survive the last few weeks of the dry season—a function traditionally provided by Acacia trees. Land stripped of trees is also exposed to wind and water erosion, stripping it of the fertile top soil and concentrating water into rills, then gullies. Water runs off the surface of barren land rather than infiltrating it and becoming available for crops or grass, or replenishing ground water supplies.

Box 1: Charcoal Production and the Market

The lack of regulation also affects participants in the charcoal value chain. Laborers reported safety and health risks such as lung infections, injuries and death due to accidental fires (Osman and Mohamed, 2014). The majority of participants in the industry are the poor, voiceless and marginalized, whose vulnerability is exploited by wealthy traders. Our interviews with rural villagers revealed that employment in the sector is largely transitory, with rural communities turning to the trade as a last resort with the intention of exiting as soon as they get back on their feet (Osman and Mohamed, 2014). The men involved in clearing and burning are often in debt, however, and their earnings cannot cover both subsistence needs and debt repayment. They become caught in what the assessment team referred to as the “charcoal production poverty trap”. Anecdotal information from respondents in Mogadishu indicated that it is common for traders to pay their laborers in kind, giving them food and khatin exchange for their labor (Osman and Mohamed, 2014; D. Rahoy, personal communication, January 31, 2014). Earnings are significantly higher for the traders as a sack sells for three dollars in the rural areas and for seven times as much in the urban areas (\$22) (Osman and Mohamed, 2014). These illegal operations contribute nothing to the country's tax base.

The only current alternative to charcoal for urban users is LPG, but this is not easily available to consumers despite a comparably favorable price. An average urban household (six members) uses four sacks of charcoal a month, spending a total of \$88, while a 20 kg LPG gas cylinder costs \$60 and lasts just as long (Jibril, 2014). Supplies of LPG in the country are smuggled out of the Gulf States, where the cost is lower due to government subsidies. The supply of illegal LPG is erratic and confined to the major coastal towns (Jibril, 2014; A. M. Dahir, personal communication, February 6 2014). An additional barrier to demand is the perception that LPG is unsafe (Jibril, 2014; A. M. Dahir, personal communication, February 6 2014). Promotion of LPG as an alternative to charcoal will require a significant investment in social marketing as well as policy reform and enforcement to rationalize charcoal production and improve the price differential.

If managed sustainably, the charcoal sector has the potential to reduce poverty in Somalia. There is currently no oversight to curb or mitigate its social and environmental externalities that are contributing to environmental degradation and deepening poverty amongst rural populations. The lack of government oversight of the sector means that the main focus across the charcoal value chain is maximization of output.

Land degradation (both physical and biological) has a direct impact on food security and livelihoods. Land carrying capacity has declined as a direct result of degradation. Respondents in all regions visited linked the declining productivity of the land to a narrowing of livelihood options available to rural populations. With fewer options comes a shift in rural demographics as the able-bodied move to urban areas in search of work, leaving the old and the very young in rural areas (Abdi and Ibrahim-Buffalo, 2014). Others have turned to environmentally destructive practices like charcoal making and to illegal activities such as piracy or recruitment into militant organizations. Large numbers of youth risk their lives attempting to migrate to the Middle East: In 2010, 53,000 persons attempted to cross the Gulf of Aden (UNDP Somalia, 2012).

Taken in concert with its effects on the hydrologic cycle, land degradation may well be the largest environmental contributor to food insecurity and poverty in Somalia.

c. Degradation of Somalia's Coast

The assessment team's brief excluded coastal and marine resources⁴. However, in the course of the assignment, the team noted several indications of degradation that could have serious implications for the health of coastal and marine ecosystems. For these reasons, a very brief description of coastal degradation is included here.

Somalia has the longest coastline in Africa (3,025 km). In the last 20 years, beaches within urban areas have been degraded as they became repositories for waste and extraction sites for the construction industry. The most recent mapping exercise by FAO SWALIM (2009) indicates that almost the entire coastline of Somalia is degraded (see Annexes for map of degraded areas). In Mogadishu and Bossaso, natural barriers such as limestone outcrops along the shoreline (see plates 3a and 3b) and wetlands are being exploited for building materials.

⁴ The scope of the assessment was limited to terrestrial resources as this was the stated priority of the Mission.

Plate 3(a): Extraction of Limestone, Mogadishu Beach (Authors, 2014)



Plate 3(b): Destruction of Natural barriers, Mogadishu Coastline (Authors, 2014)



The removal of natural barriers along the shoreline increases the likelihood of natural disasters as normal storm surges could proceed unchecked, resulting in loss of life and extensive damage to property. It also contributes to the degradation of estuarine and marine habitats. In some areas, the removal of natural barriers has paved the way for the intrusion of sand dunes inland by up to 50 km.

Respondents in Mogadishu identified the areas between Waar Sheikh and Hobyo as being particularly affected (Ali and Mohamed, 2014). Sand dunes are contributing to desertification along the coast line and have reduced access to coastal areas between Eel dheere and Harardhere (Ali and Mohamed, 2014).

2. Inadequate Access to Safe Water

The assessment team looked at two facets of water resources—quality and quantity. Water statistics for Somalia indicate that only 29.55% of the total population (UNODC, 2013) has access to an improved water supply⁵. Somalia is a water deficit country and individual water accessibility has been on the decline. Total renewable water per capita declined from 4,980 m³ to 1,538 m³ per inhabitant per year between 1962 and 2012 (FAO AQUASTAT, 2013). A further decline is projected for 2015 with individual access dropping to 888 m³ per person per year (USAID, n.d.). This is attributed to climatic conditions in the country, but also to a lack of investment in appropriate technology to harness rain water and systems for sustainable exploitation of water resources (USAID, n.d.; Njeru, 2014). A 2011 Global Water Stress Index, which includes the relationship between water supply and demand, categorized Somalia as a ‘high risk’ country (Maplecroft, 2011). In 2010, the same index ranked Somalia first amongst nations for corporate deficiency; similar statistics from FAO indicate that industry in the country accessed only 0.06% of renewable water resources in 2013 (FAO AQUASTAT, 2013). This has serious implications for investment as a whole and for employment opportunities for the youth in particular.

An analysis of available data indicates that the major sources of water in Somalia are boreholes, shallow wells, cisterns (*berkaad*) (FAO AQUASTAT, 2013). In addition, south-central Somalia has rivers, dams and springs. Nationwide shallow or dug wells are the predominant source of water, indicative of a reliance on largely seasonal surface water sources that are relatively cheap to dig. However, these are also highly susceptible to contamination from surface runoff and are usually poorly planned and sited (see annexes for a breakdown of water sources in Somalia).

a. Trans-boundary Water Resources

Somalia is a downstream user of two trans-boundary water sources, the Shabelle and Juba rivers (Shahin, 2007). The Shabelle is shared between Ethiopia and Somalia while the Juba River runs through Kenya, Ethiopia and Somalia (Shahin, 2007). The estimated supply carried by both rivers to Somalia is approximately 7.5×10^9 m³ per year (Shahin, 2007). Both rivers are crucial to Somalia’s economy as they represent the only major water supply for the country’s rice production and other traditional socio-economic activities (Mohamed, 2013). Ethiopia partially regulates the Shabelle through the Melka Wakana hydro-electric dam (completed in 1988) (FAO AQUASTAT, 2005). Ethiopia also maintains dams further downstream that control 40% of the catchment area and around 50% of the discharge (FAO AQUASTAT, 2005). Other trans-boundary water resources include groundwater aquifers in Southern Somalia that draw from connected aquifer formations from Kenya and Ethiopia (Croft, 2014; IICPSD, 2012).

⁵Defined by the UN as a source that is protected against contamination (particularly fecal contamination).

It is anticipated that Ethiopia's food security and utility policies will have serious implications for Somalia's water supply from those two rivers (Mohamed 2013). Upstream investment in major irrigation schemes and hydroelectric power generation could reduce water flows to Somalia significantly, crippling irrigation-fed agriculture and degrading riverine ecosystems (Mohamed, 2013).

There are currently no formal treaties on shared water resources between Ethiopia and Somalia (IICPSD, 2012). This is a significant gap in the sustainable management of Somalia's water resources.

b. Rural Water Supply

The use of cisterns (*berkaad*) was introduced in 1952 by Isaaq pastoralists. Those concrete underground water storage structures were originally intended as temporary water supply for domestic use to supplement water collected during the rainy seasons (Cossins, 1971 cited in Gomes, 2006). Cisterns are now being used as year-round water sources, with the attendant problems of overgrazing and thus land degradation in the surrounding areas. The use of this water for both human and animal consumption has led to deteriorating water quality due to the proliferation of algae in cisterns and contamination by bacteria and occasionally diesel oil⁶. Cisterns may have a negative impact on surface water flow and access to water in the long term. They are constructed without considering watersheds, drainage patterns or the implications for other watershed users, contributing to inter- and intra-clan conflict.

There are also serious issues associated with access to ground water resources. Borehole drilling statistics for Somalia indicate that only one in three attempts is successful (Smith, 2014; Tremblay, 2014). This is attributed to the fact that drilling projects are not informed by hydro-geological surveys and aquifer mapping as many of the aquifers' characteristics are not well understood (Smith, 2014; Tremblay, 2014). There have been several small-scale programs to remedy the lack of hydro-geological maps, but this remains a significant barrier to sustainable exploitation of water resources in Somalia—even more so considering over 60% of the aquifers in Somalia are saline (Njeru, 2014).

The relative lack of fresh groundwater sources means that what exists must be carefully managed to ensure that the rate of extraction does not exceed the recharge rate. A recent study by FAO SWALIM indicates that this is already occurring. The 2012 study covering 1,270 sites in northern Somalia showed that unregulated and uninformed drilling of boreholes is depleting ground water sources and contaminating freshwater aquifers. Aquifer levels have declined by as much as 30% in some areas; in addition, the close proximity of boreholes has resulted in interference and low yield rates, contributing to conflict between communities (FAO SWALIM, 2012; Njeru, 2014).

The lack of standards enforcement and regional water policies makes the situation worse. Several agencies have worked with regional governments to draft crucial legislation (most notably FAO Somalia), but without implementation and enforcement by the government, the exploitation of groundwater sources continues unchecked.

⁶Added to the water to prevent mosquitoes from breeding.

Box 2: Somalia's Water Policies

Somalia's first national regulatory framework for water was drafted in 1986, but the National Water Resources Law was never endorsed by parliament and was replaced in 1990 with a draft Water Law (IICPSD, 2012). The government collapsed before this was enacted. The country remained without a regulatory framework for water until 2004, when Somaliland and Puntland enacted their own regional Water Acts. Both acts drew from customary natural resource management and usage systems (IICPSD, 2012). Somaliland redrafted its National Water Act in 2008 and the revised document provides the legal framework for development of water supply in the region, outlines the responsibilities of stakeholders in the water sector and defines modalities for service delivery including PPPs (European Commission, 2012).

The low success rate of drilling projects and associated high costs have also affected donor interventions in this sector, with the majority of organizations choosing to support digging of shallow wells and the construction of cisterns. This is of concern, not only because these water sources contribute to land degradation but also because of the high rate of contamination associated with shallow wells and cisterns. While there may be an increase in the number of water sources, there is no way to guarantee that this water is safe, stalling Somalia's progress towards MDG 7.

The risk of contamination (of both rural and municipal water supply) is heightened by the lack of regulatory systems to safeguard water quality. In the regions the team visited, there was not a single laboratory for testing water chemical content. Water samples are taken to Kenya or Yemen for analysis. The only test that can be done is bacteriological and its result is not confirmatory. Respondents reported instances where arsenic and sulfides were detected in water sources and the presence of point source polluters along seasonal rivers (Artan and Jama, 2014; Sheikh-Ali, Dualeh and Noor, 2014).

c. Municipal Water Supply

In all three municipalities visited (Mogadishu, Hargeisa and Garowe), water is managed through public-private partnerships.

(i) Hargeisa Water Supply

Only 30% of the town's residents have access to piped water through the reticulation (piped) system installed under the previous government (Sheikh-Ali, Dualeh and Noor, 2014). The remaining 70% rely on water trucking with water sourced by suppliers from unregulated surface water sources (Artan and Jama, 2014). This water is delivered directly to consumers without testing or treatment. The Ministry of Water, Hargeisa Water Agency and the municipality have no oversight of the water trucking sector. Respondents from these institutions and from the parliamentary Green Caucus described several potentially serious examples of contamination of surface water sources that service the town (Artan and Jama, 2014; Sheikh-Ali, Dualeh and Noor, 2014). For instance, a leather tanning factory dumps its waste products directly into a seasonal water source that provides water for downstream users. Respondents also described instances where unscrupulous water suppliers would use the same water bowsers to de-sludge liquid waste (Islamic Development Bank, 2013). When the municipal authority attempted to regulate the supply chain, a majority of suppliers went on strike, paralyzing water supply to the town (Yusuf-Ali, 2014; Sheikh-Ali, Dualeh and Noor, 2014).

The assessment team observed the presence of a slaughterhouse waste dumpsite on the elevated side of a dry river bed (see plate 4). During torrential rains, waste overflow from the dumpsite is washed into the riverbed, which contains several shallow wells.

Plate 4: Disposal of Slaughterhouse Waste near Water Course in Hargeisa (Authors, 2014)



There are several ongoing interventions working to improve access to water for urban populations. Among them is the preparation of a water master plan for Hargeisa that includes an investment of over \$100 million in water infrastructure development by the EU Mission to Somalia (Sheikh-Ali, Dualeh and Noor, 2014).

(ii) Mogadishu Water Supply

Statistics from the Ministry of Water put per capita water consumption in Mogadishu at less than 16 liters per day (Islamic Development Bank, 2013; Yusuf Ali, 2014). Water is supplied to Mogadishu by a cooperative, Somalia Water Development (SWD). The cooperative is an amalgamation of individual water suppliers that came together to strengthen their market position (Mahad, 2014), effectively establishing a monopoly on water supply through 290 wells in the city. This comes at the expense of water quality; random water analyses indicate the presence of *E.coli*. There are frequent outbreaks of water-related diseases in the city, including the current polio outbreak linked to contaminated water supply. Over 80% of the water supplied by these suppliers is either saline or highly contaminated by sewage (Islamic Development Bank, 2013). Random testing of shallow wells within the city and at two other sites outside the city bear out these statistics (see annexes for water analysis data for Mogadishu and Puntland). Only four of the 12 water sources tested indicated zero contamination by fecal coliforms, which is the standard required for human consumption. Another

three recorded levels of between 2 and 5, which is borderline acceptable given the limitations in accessing water in Somalia (HIJRA, 2014).

Pre-civil war water supply sources are still functional though underutilized. Ceelasha is 17 km from the Central Business District (CBD) and has 33 boreholes that used to supply water to Mogadishu before the collapse of the central authority. The boreholes are high yielding (100 m³/year) and require only minor repairs (Noor, 2014). Despite the fact that these structures are operational, the government is unable to reestablish the supply of piped water to the city due to SWD's monopoly. The Ministry has convened a commission to develop options that will allow the government to integrate public and private water supply to the city (Adle, 2014). However, the Ministry of Water currently has no capacity to enforce standards or to test water quality, although the latter is soon to be remedied with funding from the EU⁷.

(iii) Garowe Water Supply

Water is supplied to Garowe is under a single PPP contract with the Nugal Water Company. The company supplies water to 5,000 households at the rate of 1,200 m³ per day (Ahmed, 2014). It estimates that 7,000 households are not connected to the water supply system and thus rely on water trucking (Ahmed, 2014). Although Garowe is the regional capital of Puntland, access to potable water remains a challenge. The existing water system was put in place by UNICEF with funds from USAID in 2002/2003. The current water infrastructure needs to be expanded so that Garowe General Hospital, the universities and other public institutions can benefit from the water system. In addition, there are 2,000 IDPs with no water supply system (Ahmed, 2014). To cover public institutions such as the hospital, an estimated 15 km piping system and three additional boreholes will be required. The local water authority (PSAWEN) raised concerns regarding both the quantity and quality of water supplied to the town (Ahmed, 2014). As the current aquifer is not a permanent one, alternative water source such as groundwater resources from neighboring aquifers or surface water harvesting (dam construction) need to be considered. With regards to water quality, the mineral content of the water supplied is questionable. PSAWEN has no water laboratory to verify the chemical content of the water consumed (Ahmed, 2014). Finally, the results of recent water analysis from boreholes across Puntland indicate high levels of biological contamination in urban and rural areas that have been attributed to the improper disposal of solid and liquid waste (Obara and Githinji, 2013).

3. Urban Waste and Pollution

Urban waste disposal in Somalia is of concern because of its impact on water quality, ecosystems and human health. The assessment team looked at waste disposal in the three urban areas—Hargeisa, Garowe and Mogadishu. The review of documents may indicate that rural areas are experiencing similar impacts⁸ (Obara and Githinji, 2013). The lack of disposal sites is of grave concern. The team visited dumpsites in all three urban centers and found that all of them were

⁷ EC-funded SECIL program: rehabilitation of the old Aquadotto center for use as a technical training center and water testing laboratory.

⁸ See also MEPS environmental verification reports.

located at sites that contribute to contamination of scarce water resources, pose a risk to human health and contribute to the degradation of ecologically sensitive areas.

In Mogadishu, solid waste (this includes offal from the slaughterhouses, e-waste and hospital waste) is dumped at two sites (Al-Jazzera and Kaaran). Both are abandoned quarry sites along the shoreline and likely produce leachate that ends up in the ocean or in the aquifers that service the town's water supply. The dumpsites are unprotected and accessible to people and domestic animals who scavenge. According to the Benadir municipal waste manager, there is no way to enforce restrictions on service delivery, so unlicensed individuals collect solid waste from households for low fees and dump it anywhere including on the streets and in the ocean (Abditidoon, 2014). This undermines the nascent waste collection businesses that the government has licensed to collect waste under a public-private partnership framework aimed at improving service delivery and cleaning up urban areas. The disposal of solid waste into the ocean has attracted shark and jellyfish and contaminated beaches near the town (D. Rahoy, personal communication, January 31 2014).

Hargeisa's main dumpsite is around 10 km outside the town and is unprotected, allowing free access. During site visits, the team observed scavengers at all dumpsites and livestock grazing within these sites (see plate 5). The slaughter waste from Hargeisa abattoirs, including blood, is dumped between two ecologically sensitive sites—a foothill and a seasonal watercourse. Downstream of the watercourse are shallow wells that supply water to the town. During the rainy seasons, this waste washes into the water course and into the wells.

Plate 5(a): Main Dumpsite: Hargeisa (Authors, 2014)



Plate 5(b): Dysfunctional Hospital Incinerator, Hargeisa (Authors, 2014)



Garowe's dumpsites are also poorly planned; the main dumpsite is located within the city limits, increasing public health risks to residents. The dumpsites are maintained through burning, which is neither effective nor efficient, contributing to air pollution (Adam-Bradford, 2013). The assessment team also found that there were no incinerators for medical waste (see plate 5(b)); hazardous waste from hospitals is disposed of at the public dumpsites. Some hospitals will hire a separate open air truck to transport the waste and supply gasoline for burning the waste at the point of disposal. However, the acting manager at Hargeisa Group Hospital, which uses this method, acknowledged that it is not effective as the waste is not completely destroyed (A.M. Dahir, personal communication, February 4, 2014). The situation is worsened by unrestricted access to these sites. Information from the Benadir waste manager indicates that syringes are scavenged from dumpsites in Mogadishu and sold to unsuspecting pastoralists who use them to inject livestock (Abditidoon, 2014).

Unlike systems for solid waste collection, which are governed by PPPs in all three urban centers, the collection of liquid waste is completely unregulated by the local authorities. In Mogadishu, liquid waste including that from the IDP camps is transported by bowzers and released into the ocean (see plates 8 (a) and (b)), while liquid waste in Hargeisa is disposed of just outside the city limits, within an area used for grazing livestock. Anecdotal information confirmed by the municipal authorities in all three urban centers revealed that water tankers are sometimes also used as exhausters; this practice poses a significant risk to human health.

Plate 6(a) Extraction of Liquid Waste, Mogadishu (HIJRA, 2014)



Plate 6(b): Disposal of Liquid Waste on Public Beaches, Mogadishu (HIJRA, 2014)



Improper waste disposal can be considered as the most urgent environmental problem facing urban populations in Somalia because of its impact on water quality and the risk of disease outbreaks it poses. Viewed against the country's growing urban population⁹ and the lack of oversight in the sector, this is an issue that requires immediate attention.

4. Regulatory Frameworks

Systems for environmental governance in Somalia exist along two lines: the traditional, communal systems (*Xeer*) and the government structures that have their roots in the colonial and pre-war legislation. The line between the two sometimes blurs as postwar structures lean heavily on the *Xeer* and the clan system of governance (Gundel, 2006). This is very much the case when it comes to natural resources management. The demarcation of land in northern Somalia (Puntland and Somaliland) suggests that approximately 50% of all land is permanent pasture, which is governed by customary law (Dullo, 2011). For Somalia as a whole, 46 to 56% of the country's land area is permanent pasture (Omuto, Vargas and Alim et al., 2009). About 14% is classified as forest and approximately 13% is suitable for cultivation (UNEP, 2005). Historically, land has always been a common asset governed by customary law (Farah, Hussein and Lind, 2002).

a. Somaliland

In Somaliland, the responsibility for land administration is divided between different ministries and levels of government (Bruyas, 2006). Overlapping mandates (Ali, 2014), poor communication, weak human and financial capacity and endemic corruption undermine the effectiveness of government structures (Dullo, 2011). This has had a negative effect on the implementation of government regulations and guidelines.

The Somaliland government recently revised its National Policy on the Environment and its Food Security and Water policies (2011) to address the legislative gaps in sustainable resource management. The former covers the key environmental threats discussed in this report as well as the additional problems of air quality and climate change, marine resource management, urban slum development and human resettlement (Ministry of Livestock, Environment and Pastoral Development, 2011).

b. Puntland

In Puntland, the government has specific regulations in place for the management of rangelands (Government Laws 2 and 3) (Dullo, 2011). The government is also drafting a new Environmental Policy. Inferring from discussions with the Ministry of Environment, it is anticipated that this will cover land, water and waste management, biodiversity and marine resource management as these are their priority areas. However, the draft has not been made public. With regards to implementation and enforcement, respondents were clear that the Ministry will require technical assistance, specifically in equipping their staff with the technical certification to serve as experts for each of the sectors the Ministry should be overseeing (Salah, Ali and Abdikadir et al., 2014). The Ministry also

⁹Urban dwellers make up approximately 37% of the total population of the country; the rate of urbanization is 3.79% per year (2010-2015 est.).

Source: CIA World Fact book (n.d.) <https://www.cia.gov/library/publications/the-world-factbook/fields/2212.html>

requested assistance in assessing the status of biodiversity and marine resources. In terms of current capacity, the departments of wildlife in both regions—Puntland and Somaliland—are particularly underfunded and understaffed (Salah, Ali and Abdikadir et al., 2014). Respondents pointed to the lack of protected areas and programs to address species loss in the two regions as serious gaps in wildlife and biodiversity conservation.

c. South Central

The bulk of the country's agricultural areas are located in south central Somalia. Prewar legislation recognized individual land ownership although Barre's administration attempted to stifle private ownership (Farah, Hussein and Lind, 2002). Despite the prolonged conflict, private land transfer systems continued to function in the region, albeit under militia control (Menkhaus, 2012 cited in Burman, Bowden and Gole, 2014). The Federal Government has made some gains in reestablishing legal frameworks for land management, but this is restricted to Mogadishu and its environs (sabahionline.com, 2013 cited in Burman, Bowden and Gole, 2014). Land management in the rural areas is completely under-regulated, with charcoaling and conflict-related migration functioning as the driving forces for land use change in the region.

d. Federal Government

At the federal level, the Ministry of Natural Resources drafted a National Environmental Policy in 2013 that covers seven sectors. Again, in addition to the key environmental threats identified by this assessment, the policy also covers marine and mineral resources (Ministry of National Resources, 2013). The policy also covers cross-sectoral issues that include gender; poverty and climate change (Ministry of National Resources, 2013). The policy document is yet to be enacted but provides a framework for sustainable management of the country's natural resources. The real challenge will be in implementing the policy approaches outlined in the document, given the political and resource limitations of the Federal Government.

e. International Agreements

Somalia is party to a number of international agreements (see list in Annexes) and has been working with UNDP and FAO (with funding from the Global Environment Facility) to meet a number of its obligations. It submitted its National Adaptation Program of Action¹⁰ (NAPA) to the UNFCCC in 2013 (Tremblay, 2014). In 2014, the Government is working with FAO to undertake its first National Biodiversity Strategy and Action Plan (NBSAP) and its fifth national report to the CBD (Tremblay, 2014). There is also an opportunity for the country to contribute to the World Ocean Assessment for 2015. Although it has the longest coast line in Africa, Somalia is the only country in Africa that has not been contributing to the African and Global Ocean's Assessment (Croft, 2014). Support to this initiative would be an important step in Somalia's progress towards reintegration into regional and international environmental networks and could be undertaken by the IOC (part of UNESCO).

¹⁰<http://unfccc.int/resource/docs/napa/som01.pdf>

f. Weaknesses in Implementation and Enforcement

A common theme in respondent feedback on governance structures for environmental protection was the lack of capacity by the government and local authorities to regulate access to natural resources—particularly exploitation of grazing lands and water points. As a result, environmental governance at the grassroots level rests in the hands of community structures and thus varies widely. This has grave consequences for the health of ecosystems on which rural communities are dependent for crucial goods and services and for security in these communities. Without oversight from the State, communities lack the means to control access to rural resources. Overgrazing, unsustainable charcoal production and improper exploitation of ground and surface water resources are all consequences of poor governance and weak institutional capacity.

An additional consequence of unregulated access to natural resources is localized conflict over these resources. Local NGOs working on peace building initiatives in rural communities in the North identify competition for diminishing resources as a major driver of small-scale conflicts – these are disputes over water, land tenure, mineral rights, enclosures, new settlements and commercial fodder farms (Abdi and Ibrahim-Buffalo, 2014). A 2011 conflict baseline by CARE Somalia also highlighted poor management practices and unclear administrative systems as contributory factors to resource-based conflicts.

Overall, with the current gaps in implementation and enforcement of state legislation, natural resource management is determined by the management structure of individual communities, with negative impacts on ecosystem health and conflict as discussed above.

C) STATUS OF BIODIVERSITY

There are no recent records of biodiversity in Somalia; in the absence of government studies, the assessment team relied on IUCN's Red List and on data from experts in Somalia. The most recent listings by IUCN are summarized in Table 2. It is important to note that habitat degradation due to unsustainable land use practices and a lack of regulation are the leading threats to the listed species. This is in accord with information obtained from sectoral experts in Somalia. The team spoke to respondents working in the following fields:

- Fodder production: Promotion of cultivation of palatable species that are in decline in rangelands;
- Researchers from the former government's Herbarium;
- Land reclamation: Reseeding rangelands with indigenous species.

Respondents linked the loss or decline of species to land degradation and the spread of invasive plants that have outcompeted indigenous plant species (A.M. Dahir, personal communication, February 4, 2014; Awale, 2014; Awaley, 2014; Hussein, Igal and Abdullahi et al., 2014). Land degradation has lessened ecosystem integrity and this has direct implications for the supply of keystone species such as bees. Native bees are primary pollinators for many species that are targeted for charcoal production, including *Acacia bussei*. The damage caused by charcoal production is not limited to the removal of biomass but also has an impact on bee populations through the destruction of habitat and smoke pollution from kilns. In addition to destabilizing ecosystems, this has impacted the production of honey, one of the few alternative livelihoods open to rural populations. Charcoal producers have noted a discernible reduction in honey output in areas where charcoal making is prevalent because of the disturbance associated with felling trees, smoke and fire outbreak (Osman and Mohamed, 2014).

Medicinal plants that grow in association with the acacia trees have been affected by the decrease in acacia populations. Somalia has 151 plants with medicinal value that rural communities are heavily dependent on due to the lack of access to modern health care. Somalia also has 3,028 higher plants; of which 17 are threatened (World Resources Institute, 2003).

Plate 7: *Optunia* sp. (left) and *Prosopis* sp. (right), Hargeisa (Authors, 2014)



A number of invasive plants have expanded into the habitat previously occupied by indigenous species. Invasive species include *Prosopis* spp. (*aligarob* or *garaanvaa*), *Parthenium hysterophorus* and *Optunia* spp. (*tiin*). The first two are spreading fast; because of their adaptive and suppressive traits, they are also a threat to livestock pasture and therefore to pastoral livelihoods. *Prosopis* in particular starves other plants of water as it has high ground water utilization rates (Adam-Bradford, 2013a). *Prosopis* is also a threat in urban areas where its root system can interfere with underground infrastructure such as pit latrines and drainage pipes (Adam-Bradford, 2013a). *Parthenium hysterophorus* entered Somalia from Ethiopia and its presence is visible in the areas bordering the Ogaden region of Ethiopia. The plant is prolific and can complete four cycles in a year, each producing thousands of seeds. There are no statistics on the spread of invasive species or studies on the areas affected by these species. With funding from the EU, FAO is currently undertaking a small remote sensing study in the South to test the use of satellite imagery in identifying *Prosopis* (Toselli, 2014).

Table 2: IUCN's Red List of Threatened Species (Species Assessed between 2008 and 2010)

Species	Assessed(year)	Listing	Threats
<i>Elapsoidea chelazzii</i> (Somali garter snake, southern Somali garter snake)	2010	Endangered ¹⁷	Habitat degradation due to overgrazing Lack of protection for wildlife
<i>Litocranius walleri</i> (Gerenuk)	2008	Near threatened	Hunting Lack of protection for wildlife
<i>Equus africanus</i> (Somali wild ass)	2008	Critically endangered ¹⁸	Limited access to drinking water and forage (largely due to competition with livestock) May also be vulnerable to hunting for medicinal purposes Lack of protection for wildlife
<i>Ammodorcas clarkei</i> (Dibatag, Clarke's gazelle)	2008	Vulnerable	Drought and habitat degradation due to overgrazing Uncontrolled exploitation of trees and scrub for charcoal Hunting Lack of protection for wildlife
<i>Beatragus hunter</i> (Hirola, Hunter's antelope)	2008	Critically endangered ¹⁹	Lack of protection for wildlife
<i>Acinonyx jubatus</i> (Cheetah, hunting leopard)	2008	Vulnerable	Habitat loss and fragmentation Lack of protection for wildlife

¹⁷Found only in the area around Afgoi in southern Somalia.The area in which this species is distributed is estimated to be less than 500 km² (INEICH, 2010).

¹⁸ Found in parts of Eritrea, Ethiopia and Somalia. It is possible that it is locally extinct in Somalia (Moehlman, Yohannes, Teclai and Kebede, 2008).

¹⁹Indigenous to south-west Somalia; its current status is unknown, however its former range has been badly affected by prolonged civil and military conflicts that continued for decades(IUCN SSC Antelope Specialist Group, 2008).

<i>Gazella spekei</i> (Speke's gazelle)	2008	Endangered	Illegal wildlife trade Lack of protection for wildlife Drought and overgrazing have degraded its range
<i>Nanger soemmerringii</i> (Soemmerring's gazelle)	2008	Vulnerable	Uncontrolled hunting, political instability, civil and military conflicts and degradation of rangeland by large numbers of livestock Lack of protection for wildlife (Heckel et al., 2008)
<i>Rhincodon typus</i> (Whale shark)	2005	Vulnerable	Unregulated fisheries (Norman, 2005)
<i>Giraffa camelopardalis</i> (Giraffe)	2010	Least concern ²⁰	Hunting and conflict across its range Lack of protection for wildlife
<i>Equus quagga</i> (Plains zebra, painted zebra, common zebra, Burchell's zebra)	2008	Least concern ²¹	Habitat loss Hunting Lack of protection for wildlife
<i>Cephalophus harveyi</i> (Harvey's duiker, Harvey's red duiker)	2008	Least concern ²²	Habitat loss due to clearing of forests
<i>Acacia bussei</i>	2012	Least concern ²³	Forest habitat in the areas where this species is found is rapidly degrading.

²⁰Could be fewer than 5,000 individuals in Somalia, Ethiopia and Kenya (Fennessy, 2007 cited in Fennessy, 2010).

²¹ Experiencing localized declines in some areas (Hack and Lorenzen, 2008).

²²In the past, found in riverine habitats on the lower Shebelle and Juba rivers, in coastal scrub and forest in the Lake Badana region. By the mid-1980s, it had lost almost its entire habitat on the Juba and Shebelle rivers to an expansion in cultivated areas. The species survived in only a few remaining patches of riverine forest on the lower Juba (IUCN SSC Antelope Specialist Group, 2008a). It is likely that the rapid pace of forest degradation in these areas has displaced this species completely from the area.

²³Population is in decline in Somalia due to the over exploitation of the species, mainly for charcoal production (Contu, 2012).

In addition to those listed above, the IUCN has noted that many species in Somalia have not been assessed by the Red List and their status is thus unknown (UNDP Somalia, 2012a). This could be indicative of significant biodiversity loss given Somalia's previous inclusion on the list of the 50 most species- and endemic-rich countries by estimated number of mammals and birds (Caldecott, Jenkins and Johnson et al., 1994).

D) LESSONS LEARNED

The lessons learned below passed two filters:

- Supported by reliable literature, preferably more than one source;
- Relevant to the USAID/EA/Somalia program.

Several program lessons should inform any programs addressing the key environmental issues discussed above:

- Construction of public facilities without social marketing on the importance of waste disposal is likely to continue contributing to the pollution of urban and rural water sources. This is particularly important given the country's reliance on hand-dug wells and cisterns;
- Land reclamation projects using appropriate technology have proven successful in rehabilitating grazing lands. So much so that the EU Mission to Somalia expanded its funding for this program, creating a separate budget line exclusively for environmental activities. Most of the funding targets rehabilitation of grazing lands in parts of Sool and Sanaag. As successful as those activities may be, the sustainability of their impact is predicated on their scale. Any involvement in rangeland rehabilitation will need to target an area large enough to support the attendant increase in the size of herd grazed in those areas. Without rehabilitation on the appropriate scale, these areas will simply be denuded quickly, pushing them over a threshold²⁴ from which there is no recovery;
- Traditional grazing systems served two purposes in the past: sustainable use of range resources and as viable coping mechanisms for drought. Reviving these systems would contribute to environmental remediation and ultimately household resilience; however, they could also reinforce women's exclusion from management structures;
- Governance is crucial to the recovery of Somalia's natural resources, which is why numerous interventions have targeted the country's regulatory environment. The regional and federal governments now have policy frameworks in place to govern the management and use of natural resources and to protect the environment. Implementation and enforcement of these policies is unlikely to occur without two things: precisely targeted capacity building of regional institutions and the strengthening of grassroots governance structures;
- Sustainable NRM starts with awareness of each individual's relationship to the environment and their capacity to change things for the better. Previous programs including the RELPA

²⁴ Many scientists believe that there may be a tipping point where an ecosystem's decline cannot be reversed and remains in a stable but unproductive state of desert scrub.

program’s ELMT and ELSE projects²⁵ and the EU Mission to Somalia’s NRM activities have demonstrated the value of creating awareness amongst communities of the importance of the environment and responsible use of its goods and services. This is a crucial first step towards creating community support for sustainable NRM;

- Illegal charcoaling is the largest contributor to land degradation in the South. Government efforts to end the trade in illegal charcoal only extend as far as the ports under their control. To be effective, any intervention aimed at restoring forests in the South also has to address the Gulf States’ demand for Somalia’s charcoal.

PART III: WHAT IS BEING DONE IN SOMALIA TODAY—EXISTING PROGRAMS

Viewed against the scale and the far-reaching impact of the environmental threats reported, one clear theme recurrently came to the forefront: Current interventions in Somalia are not keeping pace with the rate of degradation. All agencies interviewed indicated that needs for intervention far exceeded any allocated resources for such interventions. Current needs and gaps are in fact so vast that from a geographical and funding point of view, there are no identifiable overlaps in funding or existing synergies between existing programs. Other key challenges are the weak capacity of government institutions and governance structures at all levels and political instability in the South.

Key environmental programs in Somalia fall within the following broad thematic areas.

Table 3: Key Environmental Programs in Somalia by Thematic Area

Thematic Area	Agency (Implementing or funding)
Resource mapping and research	FAO, UNDP, UNEP, UNESCO, EU
Environmental services provision— Water resource management	EU, UN HABITAT, CARE, Terre Solidali, FAO
Land reclamation	EU, ADESO
Environmental services provision— Solid waste management	EU, UN HABITAT
Environmental governance	EU, CARE, UNDP, FAO
Energy	UNDP, EU, ADESO

²⁵ USAID’s Regional Enhanced Livelihoods in Pastoral Areas, Enhanced Livelihoods in the Mandera Triangle and Enhanced Livelihoods in Southern Ethiopia.

As the majority of environmental programs in Somalia cut across two or more thematic areas, the discussion below is organized by agency.

A) FAO SOMALIA

One of the aims in FAO's Strategic Framework (2000-2015) is the conservation of natural resources, particularly those located in fragile ecosystems or in environments at high risk of degradation (FAO, 1999).

I. SWALIM

SWALIM is currently testing remote sensing techniques in Hargeisa and Bossaso to determine the spread of *Prosopis* in those two urban centers. Using the same method, they are also working with the EU Mission to Somalia to monitor de-vegetation in Ras Kamboni in the South. The organization has a natural resource monitoring network covering 100 sites in Somalia that collect information on weather patterns and water systems. Six of these sites are located on the Juba and Shabelle rivers in the South and also serve as an early flood warning system for the region.

SWALIM has conducted extensive studies on water resources. The organization has an ongoing monitoring program in both regions that consists of an aquifer monitoring system of divers in test boreholes. Those are used to plot how the aquifers are functioning in four locations each in Puntland (Garowe, Bossaso, Galkacyo and Qardho) and Somaliland (Hargeisa, Borama, Berbera and Burco).

The program also covers surface water resources. SWALIM is currently conducting a study on the loss of surface water to the sea in Somaliland and are planning a similar exercise for Puntland. Those studies aim to establish the feasibility of surface water harvesting to supplement diminishing ground water resources.

2. Environmental Services Provision

Interventions in this sector are focused on developing surface water sources and improving the quality of water available from existing sources. FAO Somalia is currently working to identify potential water catchment and systems for harvesting water and rehabilitate existing dams in Somaliland. In Borama and Gebiley, FAO is supporting small irrigation systems and working directly with farmers to use water more efficiently. The organization is working with UNICEF to monitor water quality in two regions. They have set up two labs: one in Bossaso run in coordination with PSAWEN and one in Hargeisa managed by the Hargeisa Water Agency. The capacity of those labs is limited to bacteriological testing and focused on targeted sampling only e.g. testing water only where cases of illness are reported rather than scheduled testing to monitor water quality.

3. Environmental Governance

FAO Somalia has established environmental coordination committees in Puntland and Somaliland. FAO is providing technical advice to ministry staff and was involved in developing a Water Act in both regions. The organization is currently supporting the Ministry of Planning in Somaliland to draft a Water and Food Security Policy. FAO is also working with NERAD (Somaliland) and HADMA (Puntland) to develop drought contingency plans for both regions.

B) UNDP SOMALIA

UNDP is currently working with the Federal Government on a number of global programs including:

- **The Western Indian Ocean Biodiversity Conservation project:** A project covering nine countries in the Western Indian Ocean. The project purpose is to identify marine biodiversity hotspots;
- **The Extraction Industries for Sustainable Development program:** UNDP will conduct a scoping exercise on natural resources and institutional capacity to exploit them. The program aims to support the development of extractive industries in Somalia and to strengthen the regulatory framework;
- **The Economics of Land Degradation program:** This program supports environmental governance. It seeks to establish the cost of losses due to land degradation as a first step in supporting policy interventions;
- **IRENA:** With the aid of UNDP, Somalia is now a full member of this body. UNDP is also helping government conduct an assessment of renewable energy and develop an investment plan in 2014. UNDP is working with UNEP on a greenhouse gas inventory for Somalia, which will feed into developing alternative energy resources in the country;
- **UN Joint Program for Sustainable Charcoal Production and Alternative Livelihoods (PROSCAL):** The program includes regional cooperation, monitoring and community-based systems to reduce local demand for charcoal and promote alternative energy, energy efficiency and energy plantations. The program has not secured funding but has been endorsed by the Federal Government of Somalia.

In addition to the PROSCAL project, UNDP has a number of interventions in the energy sector including:

- An energy forum that was held in Somaliland in 2013. There, the Vice-President committed to halving charcoal use. Should this hold, the demand for alternative energy sources in the region will require a corresponding increase in supply;
- Testing solar energy for hotels to try and generate private sector interest. These activities are being piloted in Lower Shabelle, Qardho and Togdheer;
- Donation of 25 kVA solar generators to four hospitals in Somalia (Baidoa, Galkacyo, Burco and Garowe) to demonstrate the feasibility of using renewable energy;
- A pilot project (2011) installed medium-sized biogas digesters in Burco, Galkacyo and Mogadishu. The results show that this is a viable alternative energy source;
- A bio-gas project at Sheikh Veterinary School (boarding school with 300 students) in Somaliland. The project is meeting 30% of kitchen's energy needs and 100% of the school laboratory energy needs.

Upcoming interventions include a climate change resilience program that will look at policy and adaptation projects. However, this has not yet secured funding.

C) UNESCO

This body currently serves as the secretary to the Environmental Working Group for Somalia (members include UNDP and UNEP). The organization does not have any actual programs for Somalia but recent work implemented in Ethiopia will have implications for water resource

management in the South. In 2011, UNESCO piloted GRIDMAP technology in Kenya and Ethiopia to map ground water. The technology improves accuracy of drilling by up to 98%. The results of the GRIDMAP study in Ethiopia will help inform mapping in the lower and middle Shabelle, which is fed by upstream sources that originate in Ethiopia.

D) EU MISSION TO SOMALIA

The institution previously funded limited environment interventions under its food security budget. As of 2013, the European Union began funding environmental programming in its own right in Puntland and Somaliland (Toselli, 2014).

1. The Environment is Your Life Project

This project has a budget of 25 million euro, of which 14 million goes to 122 communities in Puntland for land reclamation through cash for work. In Sool and Sanaag, ADESO has undertaken land reclamation measures in partnership with the EU, CARE Somalia and the local authorities. These measures include the construction of check dams and the reseeded of areas between those structures. In addition, the Mission is providing technical assistance to district environmental officers and paying their salaries and logistical costs.

Although the Mission does not have any funding through its environmental budget line for the South, they are monitoring charcoal production through FAO SWALIM. They also have one person on staff who is researching the spread of *Prosopis* in the South.

The EU Mission has a small budget of 3 million euro for alternative energy projects, focused on establishing the feasibility of alternatives to charcoal. They are funding ADESO to implement a pilot project in Bossaso and eventually Galkacyo and Garowe. This project aims to establish a reliable supply of LPG gas in those urban centers.

2. Sustainable Employment Creation and Improved Livelihoods for Vulnerable Urban Communities in Mogadishu (SECIL)

UN HABITAT is implementing a 3.5 million-euro project in Mogadishu that has five result areas, three of which look at resource issues:

- Solid waste management—PPPs in four districts of Mogadishu to encourage people to pay for waste collection;
- Water quality and the handling of liquid waste—Looking at improving the quality of water from existing sources using low tech filters (such as sand filters). For liquid waste they are supporting desludging and treatment at a location to the south of Mogadishu;
- Energy—investigating the feasibility of using *Prosopis* for charcoal production and the construction of briquettes from charcoal dust by women groups as an IGA.

The EU Mission to Somalia is supporting water resource projects in the North, both rural and urban. In urban areas, they are focused on improving supply through PPPs, although this has its challenges in Somaliland where the government is reluctant to privatize those services (particularly in Burco). The Mission is funding aquifer monitoring and modeling in urban centers. This differs from SWALIM in that the Mission is implementing this activity at the project level, rather than regionally.

3. Hargeisa Urban Water Supply Upgrading Project (HUWSUP) (2013-2016)

HUWSUP is a 42-month program targeting infrastructure and capacity building implemented by UN HABITAT. The project will construct a new pipeline to service Hargeisa and will rehabilitate the reticulation system and degraded boreholes. Also planned is the exploration of Hargeisa's principal well field with the aim of expanding water supply.

The EU is funding Terra Solidali to conduct geophysical surveys in four towns in Somaliland and five towns in Puntland. DFID has asked them to consider extending the project to cover Lascanood. The challenge has been in finding qualified experts to conduct geophysical surveys and supervise borehole drilling.

The Mission has funded a study on rainwater harvesting in Hargeisa, which the Hargeisa Water Agency is already trying to implement by encouraging the installation of gutters and tanks for all new builds in the town. Through Terre Solidali and UN Habitat, the EU has also constructed two infiltration galleries, one in Hargeisa and one in Loyade (near Ethiopia). They are currently planning to construct sand dams downstream to help in the dry season.

4. Basic and Sustainable WASH for the MDGs (2011-2015)

CARE is rehabilitating water supply structures in 16 rural communities in Qardho, Ba'adweyn and Goldogob districts of Puntland.

5. Urban Water Program

This is a Puntland-wide project undertaken by Terre Solidali covering Bossaso, Qardho, Garowe, Ba'adweyn and Galkacyo. Initial findings indicate that shortages will become an issue for Garowe, both in terms of quantity and quality (salinity) (Smith, 2014). As the town is supplied by a hanging aquifer that is relatively shallow, contamination may also be of real concern (Smith, 2014).

PART IV: RECOMMENDATIONS

The following table was derived from research-based findings on the priority areas of intervention. Findings were based on the analysis of available literature, consultation with government representatives, donors and implementers and sector experts in the fields of environment and natural resources in Somalia.

Table 4: Gaps in Current Environmental Programming

Sustainable Land Use	<ul style="list-style-type: none"> • Land degradation monitoring • Reforestation of denuded areas in southern Somalia • Rehabilitation of rangelands in northern Somalia • Developing alternative energy options • Assessment and sustainable development of coastal resources
Environmental Services Provision	<ul style="list-style-type: none"> • Mapping of ground water resources • Water management : <ol style="list-style-type: none"> i. Upgrading and expansion of urban water supply systems—particularly in Mogadishu ii. Management of perennial, trans-boundary water sources in the South iii. Development of surface water sources • Solid waste management in urban areas—the disposal of hospital and clinic waste is of particular concern • Management of disposal points for solid and liquid waste in rural and urban areas • Social marketing for behavioral change on waste disposal in rural and urban areas
Conservation of Biodiversity	<ul style="list-style-type: none"> • Protection of existing genetic stock—for example, sesame and maize species • Support for plant diversity centers in Puntland and Somaliland • Re-establishment of protected areas for wildlife.
Environmental Governance	<ul style="list-style-type: none"> • Building institutional capacity of Somalia to mainstream sustainable development; in particular institutions in the green sector require a lot of support • Reintegrating Somalia into regional and international environmental networks • Promotion of sustainable natural resource management • Capacity development of government agencies and local governance structures

Out of these, subsection B) below proposes a number of quick-impact and broader interventions based on USAID Somalia's manageable interests and comparative advantage.

A) PRACTICAL RECOMMENDATIONS FOR ALL USAID CURRENT AND FUTURE PROGRAMS

The following provides specific recommendations to help mitigate any potential contribution to further environmental degradation. These recommendations principally target activities that could be contributing to the ongoing degradation of range and water resources.

1. WatSan and Small-Scale Construction

The Agency's relevant sector guidelines already include key questions regarding site selection but it is worth reiterating here in light of the ongoing damage to rangelands and to the shoreline from unregulated construction of cisterns, access tracks across rangelands and mining of sand and limestone.

- **Construction of feeder roads:** As a prerequisite to site selection, projects should first understand the flow of water into and out of any area (mapping of watersheds). Improper placement of feeder roads may contribute to water erosion or cut off runoff to existing surface water sources or terrestrial ecosystems.
- **Construction or rehabilitation of surface water harvesting structures:** These include cisterns, dams and water pans. These should be planned based on an understanding of the watershed within which they are to be sited, so as not to contribute to ongoing damage to watersheds or to conflict in the community.
- **Construction or rehabilitation of public facilities such as schools, clinics, slaughterhouses or marketplaces:** These activities should at a minimum be accompanied by social marketing targeting proper disposal of waste. This should include information on how to separate waste, the proper disposal of plastics and hazardous waste and proper location of disposal sites. Ideally, such projects should also include the physical structures necessary to dispose of waste generated by users of the facilities.
- **Sourcing of construction materials:** The assessment team noted with concern the damage to the natural storm barriers along Mogadishu's beaches. In light of this observation, the team recommends that as a precaution, all construction or rehabilitation projects in coastal areas ensure that materials are not sourced from beachside quarries.

2. cursory Review of Activities

The environmental verification reports, focused on a limited sample of USAID activities (only 5 being available for review at the time of the assessment) are indicative of minor noncompliance to respective EMMPs. Areas of concern include the improper disposal of waste at a number of rehabilitated schools and marketplaces and poor management of waste at project dumpsites. In light of these concerns, the Agency should conduct an internal review of funded activities to ensure that they are fully adhering to their activity EMMPs. In addition to those activities described under (1.) above, the Agency should also review EMMPs for health clinics (whenever applicable) to ensure that they have the physical structures in place for proper disposal of medical waste.

B) PROGRAM RECOMMENDATIONS FOR FUTURE ENVIRONMENTAL ACTIVITIES AND PROGRAMS

The health and well-being of households is linked to the health of ecosystems and of the natural-resource base upon which Somalia's key socio-economic sectors are dependent. As the analysis in preceding sections has shown, deterioration in the quality and quantity of goods and services offered by the natural environment has had a detrimental effect on food security, rural livelihoods, access to safe water and on peace and security in Somalia. The links between natural resources, conflict and poverty clearly demonstrate that actions undertaken to recover and protect the country's natural resources will ultimately contribute to peace and improved well-being for households in Somalia. Based on the degree of urgency and the scale of the damage, the assessment team has put forward a number of quick-impact and relatively longer-term recommendations, all of which will contribute to USAID's overall goal for its work in Somalia.

Quick-impact recommendations focus primarily on urban waste disposal; this is the most urgent environmental problem in Somalia today. The assessment team also recommends the mapping of ground water sources using new technology as a quick-impact intervention. This is a high-visibility activity that will have an immediate and long-lasting positive impact on the way scarce ground water resources are identified and managed.

Broader, more comprehensive program interventions are proposed to address the longer-term and larger-scale environmental problems of de-vegetation, deforestation, watershed destruction and degrading water quality in Somalia. Also included here are social marketing interventions to educate and engage communities in protecting and preserving scarce resources.

To a limited extent, the team has identified some opportunities for linkages with existing programs. However, even if environmental and natural resource management interventions are designed as stand-alone projects, it is anticipated that outputs and intermediate results will complement and support progress in the areas of agriculture and food security, conflict and crisis, and governance.

I. Quick-Impact Recommendations

a. Urban Waste Disposal systems

Poor end point disposal of liquid waste, hospital and slaughterhouse waste is a clear and imminent threat to the health of urban populations. Responses from KIIs with hospital staff, companies engaged in waste collection and representatives of the municipalities of Hargeisa, Mogadishu and Garowe clearly demonstrated the need for disposal facilities. Given that the Mission supports the construction of clinics and marketplace slaughterhouses, the assessment team recommends that the Mission also fund the construction of central disposal facilities for these facilities. Possible structures include bio-digesters for slaughterhouse waste. End point disposal of hazardous waste from hospitals would require high voltage incinerators to ensure that the waste is completely destroyed. The team recommends centralized incinerators that would serve both private and public medical facilities.

b. Mapping Ground Water Resources

The analysis of water supply in Somalia shows that there is considerable wasted effort in drilling and even greater problems with overlapping well drawdown cones²⁶. This has resulted in wells running dry and saline water intrusion into formerly sweet water wells. A major constraint when dealing with these kinds of problems is that there are limited hydro-geological maps for the country. The assessment team recommends the use of GRIDMAP technology to map the country's aquifers. The technology improves accuracy by up to 98% and has already been used in Ethiopia and Kenya, most notably in find water reserves in Turkana (Croft, 2014). The company responsible for developing this technology has in the recent past briefed the country Mission on its operations; this information is therefore already available to USAID Somalia. The assessment team recommends that USAID Somalia focus on water-stressed areas in Somaliland (as identified by the Ministry of Water) and on ground water aquifers in the South that are dependent on flows from Ethiopia. The latter is important for the sustainable management of trans-boundary water resources.

2. Broader and more Comprehensive Interventions

The assessment team recommends that USAID Somalia support interventions in the following result areas.

a. Sustainable Land Use

The assessment team recommends that USAID Somalia contribute to the recovery of rangelands and forests in Somalia through rehabilitation and reforestation initiatives. This would address the immediate causes of land degradation, that is, de-vegetation and deforestation. Proximate causes of degradation such as demand for charcoal should be addressed through sustainable charcoal production. Activities under this intermediate result include the cultivation of energy plantations and the promotion of supply and consumption energy efficiency. The team also recommends investing in alternative energy.

- **Reforestation of denuded areas in Southern Somalia:** Activities should include two components. Firstly, energy plantations for fast-growing tree species that can be used for sustainable charcoal production. Secondly, conservation areas for slow-growth, high-value plant species such as acacia to aid in the recovery of forest ecosystems. Responses from NGOs working in southern Somalia indicate that a few communities are trying to protect local resources (Ali and Ahmed, 2014). Site selection for conservation activities should therefore first target communities that have already banned logging in their areas.
- **Rehabilitation of rangelands in northern Somalia:** through the construction of gully erosion control structures to halt the spread of gullies. This should also include reseeding the

²⁶ Although on page 16, the assessment team commented on the lack of Water Testing Laboratories, none of the government or donor respondents stated that this was a priority. The current limited water testing facilities seem to be sufficient in the short term; the most urgent short term priority, particularly for government institutions is developing water sources. The EU is nonetheless investing in testing facilities for Mogadishu; South Central regions have the greatest gaps with regards to water quality and a relatively higher risk of contamination given the state of waste management in the city.

areas protected by these structures to improve soil stability and fertility. The EU Mission to Somalia is currently funding a four-year program that covers the eastern parts of Sool and Sanaag. To complement this initiative, the assessment team recommends targeting western Sool and Sanaag, but this should be confirmed by a joint determination by USAID Somalia and the Somaliland government of priority areas for rehabilitation.

Both of these sub results can be accomplished through cash for work, linking restoration activities to emergency response or food security initiatives. The deciding factor should be the scale of existing projects: Is the area of operations large enough for the investment in reforestation or reseeded activities to generate lasting returns?

(i) Promotion of Energy Efficiency

A reduction in energy loss in production and consumption of charcoal can translate to fewer trees logged if efficiency efforts are complemented by activities addressing international demand for Somalia's charcoal. Outputs under this result target existing energy sources and include the following activities:

- **Improved kilns for charcoal production:** Somalia's biomass resources are being utilized far beyond the land's capacity to replace harvested trees and shrubs. In addition to reforestation activities, USAID Somalia should promote the use of more efficient production methods. Improved kilns have been shown to produce up to 40% more charcoal than traditional kilns (Kammen and Lew, 2005).
- **Improved stoves:** Rising charcoal prices have affected the well-being of poor households and will continue to do so. High-efficiency charcoal stoves as well as improved paraffin stoves would support efficiency in consumption with the added benefit of reducing the cost of energy for poor households.

(ii) Developing Alternative Energy Options

While this will not directly address the country's reliance on biomass for household use, successful uptake of alternative energy by the utilities sector will spur interest in other forms of alternative energy by the private sector. This is crucial to creating the market conditions for the supply of natural gas for urban households. Finally, private sector investment is essential for the long-term growth and sustainability of the green sector in Somalia.

Given USAID Somalia's existing activities and associated familiarity with the energy sector in Somalia, the assessment team recommends expanding this program. Activities in Hargeisa should be expanded to meet 50% of the town's energy demand²⁷. However, investment in service provision is predicated on two prerequisites: Firstly, addressing the significant inefficiencies in power supply in Somalia's urban centers (see annex on fossil fuels and alternative energy). Secondly, activities should be implemented through existing PPPs in those centers. Companies operating in Hargeisa have already requested assistance in improving the efficiency of their operations (Arte, 2014), so there is existing demand from the private sector for this initiative.

²⁷ Estimates from the engineer overseeing the wind pilot in Hargeisa put the cost at 6 to 8 million dollars.

As stated earlier, activities must be accompanied by social marketing amongst target communities to create demand for these activities and to engage residents actively in sustainability initiatives.

b. Environmental Services Provision

The analysis of the water supply and waste management systems in rural and urban areas shows that there are critical gaps in supply and management that are contributing to the destruction of watershed and contamination of surface water courses and urban ecosystems. To close these gaps, the team recommends sub-results and outputs that focus on improving surface water harvesting and waste management.

(i) *Water Harvesting for Surface Water Points*

These are small-scale systems that collect, store and make use of local surface runoff. Given the country's reliance on surface water sources, it is important to support service provision that is well planned, sustainable and protected from contamination. There are a variety of water harvesting systems; some feed into concrete cisterns or water pans and water can be used for domestic or animal consumption or drip irrigation systems. This could be linked to rangeland rehabilitation with check dams diverting water into pans or cisterns. These activities should be predicated on a basic understanding of local watersheds—identifying and consulting users and mapping flows into and out of the system. Activities can be conducted through cash for work but must be linked to the next activity, that is, behavior change.

(ii) *Social Marketing and Behavior Change*

This is Community-Led Total Sanitation, whereby activities create awareness of the importance of proper disposal of solid and liquid waste. The aim here is increased knowledge and behavior change, particularly on separation of waste as well as halting burning of plastics and disposal of waste in and around water sources. Activities in urban areas should be linked to existing waste management systems. A common complaint from private companies operating under PPPs in urban areas is the lack of public knowledge on the importance of proper waste disposal. Social marketing can raise demand for these services, contributing to a reduction in urban waste pollution.

c. Environmental Governance

Governance is a longer-term investment for the Mission. This is an area in which USAID has a comparative advantage given its long history in Somalia. USAID support to local governance will be essential to complement the activities described above. Sustainable natural resource management must involve governance at three levels: grassroots, local and regional governments. Sub-results and outputs include the following.

(i) *Land Tenure and Resource Rights*

As discussed earlier, the conflict that has crippled Somalia is very clearly about who has control of land and resources. It is safe to say that there will be no lasting peace in Somalia unless something can be done to resolve land and resource disputes. An emerging source of conflict is the current trend of enclosures. This practice is likely to have negative consequences for the health of rangeland and the livelihoods of smallholder pastoralists. Commercial fodder production is a logical response to diminishing land cover given the economy's dependence on the livestock sector, but an unregulated land market for fodder production is not pro-poor (Burman, Bowden and Gole,

2014). It also contributes to degradation, as cutting off access to rangelands forces pastoralists to graze their stock on smaller parcels of land, causing de-vegetation.

Commercial fodder production requires careful planning and regulation to minimize externalities. Clear tenure and resource rights for historically communal land represent a crucial step in this process. The aim should be to support the development of land tenure and resource rights systems that encourage long-term investment and sustainable management of land resources. The assessment team recommends engaging the Land Tenure and Property Rights Division to support regional governments in designing land tenure systems for rangelands that are culturally appropriate and support sustainable land use.

(ii) Capacity Development of Government Agencies and Local Governance Structures

Natural resource management systems vary widely at the grassroots levels, with each community establishing its own rules of access. This has contributed to conflict over resources between neighboring communities with varying practices and has also affected the health and stability of ecosystems. To address these gaps in natural resource management, the assessment team recommends building the capacity of existing village management structures in sustainable resource management. Capacity building should also target local government and relevant line ministries, strengthening formal and informal structures as resource management depends on the involvement of all stakeholders. The starting point for capacity development should be reviving traditional pastoralist lore. Centuries-old oral knowledge on range resources will be invaluable in restoring rangelands. The IRI's activities with the Green Caucus in Somaliland could serve as an entry point for capacity building of local government and for awareness creation. Initial activities should cover districts represented by members of the Caucus.

Ultimately, good local governance and sustainable access to rural resources will be a strong defense against extremism.

(iii) Capacity Development of the Federal Government

Regional government representatives expressed some frustration with the support received from the Federal Government for environmental initiatives. Of particular concern was support in meeting the country's obligations under international treaties and accessing aid under these frameworks. The assessment team recommends targeted capacity development that will support the government in achieving specific activities related to the country's participation in regional and international resource management. Targeted capacity building will have the additional benefit of creating clearly discernible impact. Outputs include:

- **Trans-boundary issues:** The government has not made any efforts to date to negotiate shared access to the Shabelle and Juba rivers; this could have serious implications for the country's economy and for riverine communities. This activity will be crucial in light of the Ethiopian government's plans for developing large-scale irrigation and hydroelectric projects to be supplied by those rivers (Mohamed, 2013). The team therefore recommends supporting the Federal Government to work with Ethiopia to develop shared water resources;
- **Training resource managers:** Weaknesses in capacity are currently hindering efforts to engage the Federal Government in meeting its commitments under international environmental agreements. This is also holding back environmental programs initiated by regional governments as they are unable to access funding for national programs without the

active support of the Federal Government. Capacity building activities that are built around assessments, reporting and program design for international and regional networks will help reintegrate Somalia into these networks and allow regional governments to pursue environmental objectives that cannot be funded under emergency and relief aid for Somalia. One such activity is the 2015 Global Ocean Assessment; Somalia is the only country in Africa that is not contributing to this report. Support to this initiative would be an opportunity for the country to finally take stock of its coastal resources. An assessment of coastal resources is an essential step towards sustainable development of what is becoming Somalia's next frontier for economic growth.

- **Attempting to establish a temporary ban by Gulf States on charcoal imports from Somalia:** Current efforts by the government of Somalia to curb illegal charcoaling are not addressing market demand for this environmentally destructive product in Gulf States. Activities that promote sustainable charcoal will address local impact, but to be effective, they must be complemented by a reduction in the demand for Somali charcoal exports. To achieve this, the assessment team recommends that USAID activities provide capacity support to the Federal Government in lobbying for and negotiating a temporary ban on charcoal imports to Gulf States. Reducing demand for charcoal is the most effective means for slowing unsustainable extraction of biomass and creating the market conditions for sustainable charcoal production that is focused on domestic markets.

ANNEXES

ANNEX I: SCOPE OF WORK

Environmental and Natural Resource Management Assessment for Somalia (ENRM Assessment)

Work Order

Last updated: 08 January 2014

I. Assessment Purpose and Audience

The purpose of this assessment is to identify the most significant environmental issues and challenges affecting Somalia today, identify activities currently undertaken by donors and implementers on the ground today and to highlight which environmental activities USAID may wish to support based on the assessment's findings and analysis. USAID has no dedicated environmental/natural resource-focused activity in Somalia. The assessment will provide required context and analysis to help USAID determine how to possibly contribute to reducing environmental degradation within natural constraints of time, resources and strategic considerations. The assessment will also examine the physical, human and regulatory limitations and opportunities associated with each key issue (primarily based on lessons-learned as well as feedback from key stakeholders) to help identify needs and priorities. Findings may also be used to inform USAID on potentially negative environmental impact its activities may have on Somalia and how to mitigate these impacts. The assessment will complement the Code of Federal Regulation 216, relating to compliance of USAID programming in Somalia and that of the host government.²⁸

The primary audiences for this assessment are USAID Somalia and USAID/East Africa.

II. Assessment Context

In order to facilitate the assessment's rapid timeframe, USAID expects that most significant issues affecting the Somali environment landscape will include some or all of the following²⁹, serving as illustrative examples to be confirmed through the research and interviews conducted by the assessment team:

²⁸ Regulation 216.6 (b) specifies that “*Collaboration with affected nation on preparation. Collaboration in obtaining data, conducting analyses and considering alternatives will help build an awareness of development associated environmental problems in less developed countries as well as assist in building an indigenous institutional capability to deal nationally with such problems. Missions, Bureaus and Offices will collaborate with affected countries to the maximum extent possible, in the development of any Environmental Assessments and consideration of environmental consequences as set forth therein.*” For further detail go to: <http://www.gpo.gov/fdsys/granule/CFR-2011-title22-vol1/CFR-2011-title22-vol1-sec216-6/content-detail.html>

²⁹ USAID will provide the assessment team with key research documents conducted to date, along with contact details of key institutions and individuals expected to be most informed the team on key environmental issues.

1. Charcoal industry& deforestation
2. Prosopis spread
3. Degradation of farmable lands
4. Urban waste management
5. Land use policies and grazing
6. Food security and livelihoods
7. Toxic waste dumping and disposal
8. Environmental regulatory frameworks and capacity for policy formation
9. Wildlife
10. Water rehabilitation systems

III. Framework of the Assessment and Associated Questions

Research, key findings and recommendations resulting from this Environmental and Natural Resource Management Assessment for Somalia (ENRM Assessment) will be captured in a final report (up to 30 pages long) addressing USAID needs and priorities by adhering to the following recommended format and addressing questions within, as outlined below:

PART I – CONTEXT AND KEY ISSUES

A) Somali context and key factors

Somali context and key factors most directly affecting Somalia's environmental and Natural Resource Management landscape today. This section could include a brief description of the governance, institutional landscape and legal framework, and their contribution towards bettering or worsening key environmental issues described below.

B) Key Environmental issues

Each issues emerging out of the desk and interview based research will be succinctly described addressing all questions below:

- *Which environmental issues have the most negative effects on Somalia?*
- *What are the causes of these identified issues? What are the interrelationships between the environmental problems facing Somalia and the various drivers of environmental degradation?*
- *Which issues seem to be the most damaging to the livelihood of Somalis?*
- *Which issues are cross-regional? Which are region-specific?*
- *What regulatory frameworks exist and which ones are missing to address the identified issues?*
- *How is the trade-off managed between protecting and nurturing the environment and the need to foster human and economic development?*

Issues included above should be selected based on their degree of importance and have some degree of manageable interest to USAID. A brief mention of other possible issue could also be made.

PART II – WHAT IS BEING DONE IN SOMALIA TODAY – EXISTING PROGRAMS

Description of all key environmental programs and activities being funded and implemented by various donors and implementers in Somalia today, focusing on clearly identifying where they work, what they do, what their strategy and who are their key partners, as well as the key challenges, gaps and needs identified by donors/implementers/beneficiaries themselves which they felt most affect the perceived effectiveness of these programs, on the short and longer term.

PART III – RECOMMENDATIONS

- A) **Practical recommendations for all USAID current and future programs** (i.e., rules of engagement and considerations to help mitigate their possible contribution to further environmental degradation)
- B) **Program recommendations for future environmental activities and programs**
- **Relatively quick impact Recommendations** – High returns options for consideration
 - **Broader and more comprehensive interventions** with potentially greater impact and greater returns on the longer term.

Note on the weighing of the report: roughly two-thirds of the report should be dedicated to the first section of the report (Context and key issues) which will help to inform the Environmental Threats and Opportunities Assessment (ETOA) that USAID will subsequently produce.

IV. Methodology

The team will design and employ a mixed-methods approach, gathering and then analyzing data from desk review materials; key informant interviews; site observations and possibly remote sensing. . For the analysis, the team will apply a form of triangulation of a) data and b) sources to ensure that there is adequate and sufficient data points to corroborate findings, conclusions and recommendations to USAID. Feedback from USAID will be essential following each phase of the assessment (see deployment schedule) to make sure the assessment is grounded on USAID manageable interests, Mission constraints and priorities.

Given the diversity of sector expertise required to conduct a rigorous and comprehensive assessment, the assessment team will be made up of a two-person team with complimentary expertise related to natural resource management, the environment in Somalia and assessment-related experience, supported by up to two additional shorter term subject matter experts (during Phase III only), if deemed necessary once sub-areas of focus are approved by USAID (following desk review, field-based work and consultations with USAID). Sub-expertise which may be called upon may include: Urban waste management, land use policies and grazing, charcoal production and deforestation, food security and livelihoods, prosopis, toxic waste dumping and disposal, wildlife, and water rehabilitation systems.

V. Assessment Milestones & Deliverables

The assessment will be conducted in three phases.

I. **Phase One: Kenya-based Desk review& interviews of key informants**

Deliverable 1: Assessment Methodology and Work Plan

Deliverable 2:Phase I Debrief: Overview of current environmental activities and programs and a brief overview of key issues emerging through the desk review and Nairobi-based interviews. Early findings will contribute to informing Phase 2 (Somalia travel and interview plan) and Phase 3 (analysis and recommendations).

2. **Phase Two – Somalia based interview work:**Somalia-based interviews and site observations

Deliverable 3: Phase II Out-brief focusing again key findings this time based on Somalia-based interviews, beneficiary feedback, observations and additional documentation.

3. Phase Three: Analysis and Report Writing

Deliverable 4: *Submission of draft report*

Deliverable 5: *Submission of final report*

Milestones and deliverables described in greater detail below:

1. PHASE ONE: Work plan, Methodology, Desk review, Nairobi-based key informant interviews

Phase One will primarily consist of a desk review and Nairobi-based key informant interviews meant to provide background to the issues, and to identify and analyze relevant material to answer the assessment questions. This phase could use environmental reports, studies, research, evaluations, strategies and plans to inform the team's assessment. This initial phase will also include key informant interviews with stakeholders in Nairobi, possibly including USAID personnel.

This assessment should range widely across academic, governmental, media, and nongovernmental, civil society, and private sectors to identify relevant material and issues for review and Nairobi based interviews. An important objective of the desk review will be to ensure that the study does not duplicate earlier research efforts, and takes full advantage of the research, assessment and work that has already been accomplished by other organizations.

Towards the beginning of Phase One, the team will submit the proposed assessment methodology, work plan and outline of the anticipated report. At the end of Phase One, the team will produce a succinct briefing of their findings to USAID and the MEPS management team. The debrief meeting will provide an opportunity for USAID to provide feedback on anticipated USAID interests & priorities to help frame the assessment report.

2. PHASE TWO: Somalia-based Field Research

Key informant interviews, observations and documentation will provide a primary source of information and analysis for the assessment. The assessment team will travel to the key regions of Somalia (Somaliland, Puntland and South Central (Mogadishu and other areas if security allows) to meet with key informants and gather information and data. Interviews and correspondence should be conducted with individuals and institutions drawn from the following populations.

USAID:

- Relevant USAID personnel from the USAID Somalia and East Africa.

Somalia Government:

- Key officials and advisors on environmental matters in the Somalia Government
- Local government officials
- Key officials in line ministries responsible for agriculture, economic development, irrigation, livestock.

Civil society and community level representatives in Somalia

- Representatives from civil society, community-based organizations or local leadership to explore the ground reality of environmental issues and their interplay with other issues affecting Somalis
- They may include focus groups at the district level.

International Organizations and NGOs active in Somalia

- UNEP
- ADESO
- Other relevant Environment INGOs

The team will also conduct site observations of a pre-selected sites relating to the environmental issues described above, noting especially environmental impact (if any). These observations will be supported by photographic evidence.

3. *PHASE THREE: Analysis, Recommendations & Report Writing*

The final stage in the assessment process will be synthesis and analysis of the data and information collected into a report. At this phase, structuring the report to the assessment questions will be critical. Supporting evidence as to how findings, conclusions and recommendations were reached may require analytical and conceptual frameworks so that the mechanics of how conclusions and recommendations were reached are understandable to the report's readers.

This phase allows the opportunity for the project team to hire short term technical experts to assist with in-depth analysis of selected key environmental issues and how USAID can positively affect these issues in Somalia through programmatic activity. Additional desk research and Nairobi-based interviews may also be required to compliment findings and strengthen report findings and recommendations.

VI. Assessment Report, Personnel& Deployment Plan

A. *Assessment report content and format*

The consultant shall submit a draft I report upon completion of phase One and Phase Two deliverables described above (as described in the schedule of deliverables). This document should explicitly respond to the requirements of the SOW, should answer the assessment questions, be logically structured, and adhere to the relevant research standards subject to USAID's guidelines, as suggested by Monitoring and Evaluation Program for Somaliland USAID, to ensure the quality of the assessment report. Final report should include an executive summary, introduction, background of the assessment, methodology, major findings, conclusions and recommendations. The report should not exceed 30pages, excluding executive summary and annexes. Summary, draft, and final reports should substantively follow the three main sections outline and standard formatting outlined in relevant USAID guidelines. The consultant shall submit the final report shortly after USAID comments are provided (as outlined in the schedule of deliverables).

1. Findings
2. Conclusions
3. Recommendations & Lessons learned

B. Team

Team Leader

The Team Leader must have experience with and understanding of USAID environmental programming in complex, post-conflict environments. He/she must be a Somali speaker with strong team management skills, and sufficient experience in environmental research to ensure a credible, actionable, insightful product. The appropriate team leader is a person with whom the Mission Environmental Officer for Somalia can develop a working partnership as the team moves through the assessment and research design and planning process. He/she must also be a person who can deal effectively with senior U.S. and host country officials and other leaders. Experience with USAID is an important factor, particularly for technical research assessments, and assessments to establish the basis for future USAID programming.

Assessment Coordinator

The Assessment Coordinator should straddle a project management role and provide genuine subject matter expertise to the team. He/She should be a Somali speaker with practical experience in environmental programming and assessments. He/She should be a strong technical environmental writer and also possess good research and analysis skills. He/She must have field experience in Somalia and demonstrate expertise in the areas of interviewing, data collection and data management. He/She must be able to assist in facilitating meetings with a variety of stakeholders in Somalia. He/She also has responsibility for managing the meeting deadlines for key assessment deliverables and assisting the team leader in delivering a strong useable report as per the terms of the SOW.

Short Term Technical Experts

The Assessment Team has the option to hire of up to two short-term subject matter experts during the research and analysis phase of the assessment. These consultants should have highly specific expertise in their subject areas and knowledge of how to program within the environmental issues in their areas of expertise..

Home Office Support

The IBTCI Home Office will provide quality assurance support by providing a team member with credentials and expertise in environmental assessments. Additionally, IBTCI Home Office will provide publication support in finalizing the evaluation report.

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ANNEX III: DETAILED METHODOLOGY, WORKPLAN AND KII TOOL

I. Methodology

The purpose of the assessment is to identify significant environmental issues and challenges affecting Somalia and highlight the ones that can be supported by USAID based on the outcomes of the assessment. Environmental issues in Somalia are diverse in terms of sectors and regions; this coupled with the fact that the country has been unstable for decades, has meant that environmental issues have not received due attention. The assessment will provide required context and analysis to help USAID determine how to possibly contribute to reducing environmental degradation within natural constraints of time, resources and strategic considerations.

With these facts in mind the assessment team will deploy a mixed approach to gather comprehensive data, analyze and synthesis into a comprehensive report that meets the expectations of the primary audience (USAID Somalia and USAID/EA) and other wider interested parties. To meet the purpose of the assessment and implicitly that of the audiences, secondary and primary data will be collected and analyzed using content analysis technique¹. The results will also be presented in the form of tables and maps for easy visualization, interpretation and understanding of the narrative. For purposes of inclusivity, data collection will be gender sensitive.

The assessment will be descriptive in approach and will use purposive and snowball sampling techniques. To minimize sampling and statistical errors the sample size will be greater than 35 respondents. Secondary data will be collected through a review of relevant documents on natural resources and related environmental issues from government ministries, donor organizations, UN bodies, civil societies and research institutions. The review will include documents on policy and legislation and program/project (completed and on-going) handled by government ministries and the above mentioned organizations for expert opinions on environment and natural resources related issues in country. Primary data will be collected through open-ended-interview of government, local and international organization staff and members of professional bodies involved in environment and natural resources in Somalia.

Open ended interviews: The interview will administer to respondents in Nairobi and Somalia and will be guided by a basic checklist that will help solicit data about each respondent: name, title, organization, contact information as well as the following substantive standard parameters:

- ☐ What does the organization do?
- ☐ Where do they get their funding?
- ☐ What is their geographic spread?
- ☐ How are their activities relevant to ENRM in Somalia?
- ☐ Who else is working in Somalia to address these issues?

The interviews will also be structured against a topic checklist informed by the following questions which will form the core of the assessment:

- ☐ Which environmental issues have the most negative effects on Somalia?
- ☐ What are the causes of these identified issues? What are the interrelationships between the environmental problems facing Somalia and the various drivers of environmental degradation?
- ☐ Which issues seem to be the most damaging to the livelihood of Somalis?
- ☐ Which issues are cross-regional? Which are region-specific?
- ☐ What regulatory frameworks exist and which ones are missing to address the identified issues?

□ *How is the trade-off managed between protecting and nurturing the environment and the need to foster human and economic development?*

To supplement data collected and cross-check the accuracy of the information, site visits and interactive field observation will be undertaken. Field data will be supplemented with photographs and GPS coordinate points. If possible, satellite images on *prosopis* sp (or any other invasive plants) will be acquired and analyzed using Eseri Arc GIS (GIS and RS data). This will be used to describe trends and distribution of the plant in Somaliland, Puntland and Mogadishu for purposes of prioritization and precisely targeted interventions.

II. Report Outline

- i. Executive summary
- ii. Introduction
- iii. Background of the assessment
- iv. Methodology
- v. Major findings
 - a. Context and Key Issues
 - b. Key environmental programs in Somalia
- vi. Recommendations
 - a. Practical recommendations for all USAID current and future programs
 - b. Program recommendations for future environmental activities and programs

Note on the weighing of the report: roughly two-thirds of the report will be dedicated to Major Findings (Context and key issues) which will help to inform the envisaged Environmental Threats and Opportunities Assessment (ETOA) that USAID will subsequently produce.

III. Work Plan

Somalia - Environmental and Natural Resource Management Assessment - Work Plan				
Date	Activities/Tasks	Phase	Deliverables & Key events	Location
Monday, January 06, 2014	Team assembles in Nairobi	PHASE I	Kick off meeting USAID	Nairobi
Tuesday, January 07, 2014	USAID meeting			Nairobi
Wednesday, January 08, 2014	Nairobi - Phase I			Nairobi
Thursday, January 09, 2014	Nairobi - Phase I			Nairobi
Friday, January 10, 2014	Nairobi - Phase I		Deliverable 1: methodology & work plan	Nairobi
Saturday, January 11, 2014	Nairobi - Phase I			Nairobi
Sunday, January 12, 2014				Nairobi
Monday, January 13, 2014	Nairobi - Phase I			Nairobi
Tuesday, January 14, 2014	Nairobi - Phase I			Nairobi
Wednesday, January 15, 2014	Nairobi - Phase I			Nairobi
Thursday, January 16, 2014	Nairobi - Phase I			Nairobi
Friday, January 17, 2014	Nairobi - Phase I			Nairobi
Saturday, January 18, 2014	Nairobi - Phase I			Nairobi
Sunday, January 19, 2014				Nairobi
Monday, January 20, 2014	Nairobi - Phase I	PHASE II	Deliverable 2: PHASE I DEBRIEF & USAID Feedback	Nairobi
Tuesday, January 21, 2014	Nairobi - Phase I			Nairobi
Wednesday, January 22, 2014	Phase I - USAID debriefing			Nairobi
Thursday, January 23, 2014	Phase II - Travel to Hargeisa			Hargeisa
Friday, January 24, 2014				Hargeisa
Saturday, January 25, 2014	Phase II - Hargeisa			Hargeisa
Sunday, January 26, 2014	Phase II - Hargeisa			Hargeisa
Monday, January 27, 2014	Phase II - Hargeisa			Hargeisa
Tuesday, January 28, 2014	Phase II - Hargeisa			Hargeisa
Wednesday, January 29, 2014	Hargeisa – Mogadishu			Hargeisa-Mogadishu
Thursday, January 30, 2014	Phase II – Mogadishu			Mogadishu
Friday, January 31, 2014				Mogadishu
Saturday, February 01, 2014	Phase II – Mogadishu			Mogadishu
Sunday, February 02, 2014	Phase II – Mogadishu			Mogadishu
Monday, February 03, 2014	Phase II – Mogadishu			Mogadishu
Tuesday, February 04, 2014	Phase II – Mogadishu			Mogadishu
Wednesday, February 05, 2014	Mogadishu – Garowe	PHASE III	Deliverable 3: PHASE 2 Out brief & USAID Feedback	Mog-Garowe
Thursday, February 06, 2014	Phase II – Garowe			Garowe
Friday, February 07, 2014				Garowe
Saturday, February 08, 2014	Phase II – Garowe			Garowe
Sunday, February 09, 2014	Garowe-Nairobi			Garowe-Nairobi
Monday, February 10, 2014				
Tuesday, February 11, 2014	Nairobi - Phase II out brief prep			Nairobi
Wednesday, February 12, 2014	Nairobi - Phase II out brief prep			Nairobi
Thursday, February 13, 2014	Phase II Out brief			Nairobi
Friday, February 14, 2014	Phase III - Draft I analysis & writing			Nairobi
Saturday, February 15, 2014	Phase III - Draft I analysis & writing			Nairobi
Sunday, February 16, 2014				Nairobi
Monday, February 17, 2014	Phase III - Draft I analysis & writing			Nairobi
Tuesday, February 18, 2014	Phase III - Draft I analysis			Nairobi

Wednesday, February 19, 2014	&writing Phase III - Draft I analysis & writing		Nairobi
Thursday, February 20, 2014	Phase III - Draft I analysis & writing		Nairobi
Friday, February 21, 2014	Phase III - Draft I analysis & writing		Nairobi
Saturday, February 22, 2014			
Sunday, February 23, 2014			
Monday, February 24, 2014	Phase III - Draft I analysis & writing		Nairobi / Mombasa
Tuesday, February 25, 2014	Phase III - Draft I analysis & writing		Nairobi / Mombasa
Wednesday, February 26, 2014	Phase III - Draft I analysis & writing		Nairobi / Mombasa
Thursday, February 27, 2014	Phase III - Draft I analysis & writing		Nairobi / Mombasa
Friday, February 28, 2014	Phase III - Draft I analysis & writing		Nairobi / Mombasa
Saturday, March 01, 2014			
Sunday, March 02, 2014			
Monday, March 03, 2014	Phase III - Draft I analysis & writing		Nairobi / Mombasa
Tuesday, March 04, 2014	Phase III - Draft I analysis & writing		Nairobi / Mombasa
Wednesday, March 05, 2014	Phase III - Draft I analysis & writing		Nairobi / Mombasa
Thursday, March 06, 2014	Phase III - Draft I analysis & writing		Nairobi / Mombasa
Friday, March 07, 2014	Phase III - Draft I analysis & writing	Deliverable 4: Draft I & out brief	Nairobi
Saturday, March 08, 2014			
Sunday, March 09, 2014			
Monday, March 10, 2014	USAID review of Draft Assessment		
Tuesday, March 11, 2014	USAID review of Draft Assessment		
Wednesday, March 12, 2014	USAID review of Draft Assessment		
Thursday, March 13, 2014	USAID review of Draft Assessment		
Friday, March 14, 2014	USAID review of Draft Assessment	USAID feedback on Assessment	
Saturday, March 15, 2014			
Sunday, March 16, 2014			
Monday, March 17, 2014	Finalization of Assessment report		
Tuesday, March 18, 2014	Finalization of Assessment report		
Wednesday, March 19, 2014	Finalization of Assessment report		
Thursday, March 20, 2014	Submission of Final Report	Deliverable 5: Submission of Final Assessment Report	

IV. Environment Assessment Key Informant Interview (KII) Guide

(This guide will be used by the assessment team)

Date: _____ Location: _____

Name of respondent: _____

Designation: _____

Background

Hello my name is . Thank you for your time and your willingness to participate in this interview. The interview is part of a wider environment assessment for USAID. The purpose of the assessment is to identify significant environmental issues and challenges affecting Somalia and highlight those that might be supported by USAID based on the outcomes of the assessment. Environmental issues in Somalia are diverse in terms of sectors and regions; this coupled with the fact that the country has been unstable for decades, has meant that environmental issues have not received due attention. The assessment will provide required context and analysis to help USAID determine how to possibly contribute to reducing environmental degradation within natural constraints of time, resources and strategic considerations.

01. **Background** information on respondent (gauge degree of involvement issue / region under assessment):

- Length of time working in position/area/region
- Previous position
- Other relevant information
- Common Rule

02. **Main Questions (Closed)**

What does your organization do in Somalia? **Closed**

What is your geographic spread? **Closed**

Who are your partners in the projects/programs in the regions you are operating? **Closed**

03. **Main Questions (Closed and Probed)**

What are the environmental and natural resources degradation issues and/or examples experienced in this region? **Probe**

Which environmental and natural resources degradation issues are of *priority* (suggestion selection criteria) in the region(s) you are working and Somalia in general? **Probe**

What are the causes of these issues? **Probe**

Which issues seem to be the most damaging (directly or indirectly) to human livelihoods and health in Somalia? **Probe**

Which issues would you consider cross-regional? Which are region-specific? Are there hotspot areas? (Explain term) Has there been a spill-over of issues into other regions and/or have specific natural resources issues had an unintended effect on other natural resources? **Probe**

How is your organization addressing these issues? **Probe**

Are there other organizations you know of in Somalia who currently address issues of environmental and/or natural resources degradation? **Closed**

If so, how do these organizations address issues? Are they similar? Different? **Probe**

Do you require involvement of other partners to support you in your efforts to address these issues? **Probe**

If other partners were to get involved in addressing this issue/these issues, how would you suggest a working modality or partnership? **Probe**

Are you familiar with any existing regulatory frameworks in Somalia related to the environment?

Closed

If so, are there strengths? Are there weaknesses or absences you've observed that require additional legislation? **Probe**

In closing, do you think partners working in Somalia pay sufficient attention to environmental issues? **Closed**

If so, why or why not? **Probe**

Do you have any recommendations on how interested or vested partners might better address these issues? **Probe**

Do you think the Federal Government pays sufficient attention to environmental issues? **Closed**

If so, why or why not? **Probe**

Do you have any recommendations on how the Federal Government might better address these issues? **Probe**

How can environmental and natural resources issues in Somalia be best tackled to address existing some of the current economic and social problems in the country? **Probe**

04. Comments.

Thank you.

ANNEX IV: LIST OF PERSONS CONTACTED

	NAME	TITLE	ORGANIZATION/CONTACT
1.	Sadia Muse Ahmed	Country Representative	PENHA, sadiama@hotmail.com
2.	Mohamed Ali	Executive Director	HORN PEACE
3.	Abdullahi Khalif Abdi		HORN PEACE
4.	Ahmed Ibrahim Awale	Fundraising & M/E Officer	CANDLELIGHT, ahmedawale@candlelight.org
5.	Umar Sheikh Abdullahi	Executive Director	HAVOYOCO ed@havoyoco.org
		Director	KEEPS Waste Management Co.
6.	Mohamed Ibrahim	Program officer	SOLPAF, abdirahim@solpaf.org
7.	Mohamed Muse Awalay	Director	NERAD, awalenerad44@yahoo.com
8.	Dr. Abdi Aw Dahir Ali	Minister	Ministry of Livestock, Somaliland
9.	Eng. Mohamed Ismail Hussein	Senior Program Officer	HARDO, hardohargeisa@gmail.com
10	Eng. Arte		PEGS Program, DAI
11	Ali Ahmed Abdi	Assistant Executive Director	HAQSOOR, +252-63-4417701
12	Ahmed Mohamed Igal	Executive Director	HARDO, hardohargeisa@gmail.com
13	Usman Abdullahi	Senior Program Officer	HARDO, hardohargeisa@gmail.com
14	Zeinab Y. H Adan	Executive Director	SORADI, zadan@soradi.org
15	Abdirahman Y. Artan	MP, House of Representatives	Green Caucus
16	Abdirahman Mohamed Jama	MP, House of Representatives	Green Caucus, adadlay@gmail.com
17	Mustafe Mohamed Xudur	Director	MADO, +252-634424776
18	Rashid Ibrahim-Buffalo	Executive Director	HAQSOOR, rdbuffalo@gmail.com
19	Abdillahi Ismail Farah	Director General	Ministry of Agriculture, d.g_moa@hotmail.com
20	Ibrahim Ali Hussein	Director General	Ministry of Environment, Somaliland. Forestry and Rangelands Management Department, moerd@somalilandgov.com
21	Abdirahman Sheikh Ali	Director of Management and Water Regulations	Ministry of Water, Somaliland, ajowhar5g@hotmail.com
22	Eng. Said Dualeh	Director of Planning, Coordination & Research	Ministry of Water, Somaliland, saeedkudhe@gmail.com
23	Mohamed Hussein Noor	Director of Finance and Administration	Ministry of Water, carbarar10@gmail.com

24	Ahmed M. Dahir	Acting Manager	Hargeisa Group Hospital, HGHospital@hotmail.com
25	Khadar Yousuf Ali	Director of Social Affairs	Hargeisa Municipality, khardarcy@hotmail.com
26	Ahmet Gocer	Deputy coordinator	TIKA, (Turkey) a.gocer@tika.gov.tr
27	Guneyt Arik	Urban waste manager	TIKA (Turkey), +254616452802
28	Mohamed shek Mahad	Member	Somali Water Development Co, somwaterdev@gmail.com
29	Musa AbditiDoon	Waste Manager	Benadir Regional Authority
30	Eng. Ali Noor	Borehole Manager	Caylaysha boreholes
31	Jama Gedi	Officer	Water Agency, Mogadishu
32	Umar Haji Mohamed	Water Engineer	Ministry of Water, Mogadishu
33	Nasruddin Adle	Director of Water	Ministry of Water, Mogadishu
34	Yunis Yero Ali	Program Manager	MURDO, +252-710131021
35	Ahmed Aden Mohamed	Program Manager	CARE, +252-618105533
36	Daud A. Rahoy	Officer in Charge, Somalia	HIJRA, +252-615696014
37	Mohamed Osman		Camp owner, Charcoal maker
38	Mukhtar Mohamed		Camp supervisor, Charcoal maker
39	Abdirahman Siyad Ahmed	Engineer	General Somalia Electricity Authority, Siiid49@hotmail.com
40	Abdinasir H. Mohamed	Deputy Government Director	Nugal region Sabawanag Waste Mangement Co.,sabagarowe@gmail.com
41	Qassim Mohamed Abdil	Mayor	Garowe, +252-90747448
42	Abdirizak P. Mohamed	Consultant	JPLG, adbirizak105@gmail.com
43	Mohamed Abdi	Officer	Sabawanag Waste management Co., sabagarowe@gmail.com
44	Guled Salah	Minister	Ministry of Environment, Puntland
45	Farah Ali	Vice Minister	Ministry of Environment, Puntland
46	Mohamed AbdiKadir	Director General	Ministry of Environment, Puntland
47	Abdikani Elmi	Former Minister	Ministry of Environment, Puntland
48	Burhan Elmi	Former Vice Minister	Ministry of Environment, Puntland
49	Abdullahi Abdirahman	Director	HADMA
50	Abdi Nur Said		Nugal Water Co., Nuwaco.nugal@hotmail.com Abdinorahaji@hotmail.com
51	Mukhtar Abdirahm	Director, Projects	PSAWEN,

	Ahmed	&Programmes	psawen@hotmail.com
52	Abdi Mohamed Dahir	Program Director for NRM	ADESO, Amdahir@adesoafrica.org
53	Abdul Qadir Rafiq	Project Manager – Environment and Energy	UNDP, adbul.qadir@undp.org
54	Nicolas Tremblay	Programme Coordinator	FAO Somalia, nicoloas.tremblay@fao.org
55	Sylvia Wachira	Environment Officer	FAO Somalia, Sylvia.wachira@fao.org
56	Ugo Leonardi	Remote Sensing Officer	FAO Somalia
57	Jeremiah G. Njeru	IM & Capacity Development Coordinator	FAO Somalia, jerimiah.njeru@fao.org
58	Simon Mumuli	Land Use Expert	FAO Somalia, simon.mumuli@fao.org
59	Deegan Ali	Executive Director	ADESO, dali@adesoafrica.org
60	Helen Altshul	Head of Programs	ADESO, haltshul@adesoafrica.org
61	Britta Peters	Project Coordinator , SECIL	UN Habitat, britta.peters@unhabitat.org
62	Andrew Adam Bradford	Director, HoA Unit	Human Relief Foundation, adambradford@hrf.co.uk
63	Mohamed Dahir	Director	HIJRA, m.dahir@hijra.or.ke
64	Abdulkareem Kipchumba	Water engineer	HIJRA, a.kipchumba@hijra.or.ke
65	Bashir Mohamed	Program Manager	WASDA, bashir.hashi@wasda.or.ke
66	Rahma Abikar	Program Officer	WASDA, rahma.abikar@wasda.or.ke
67	Paul Smith	Infrastructure Program Manager	EU Mission to Somalia, Paul.SMITH@eeas.europa.eu
68	Paulo Toselli	Food Security, Program Manager	EU Mission to Somalia, paolo.toselli@eeas.europa.eu
69	Abdi Maalim	WASH Cluster Co-Chairman	OXFAM
70	Michael Croft	Program Coordinator	UNESCO, m.croft@unesco.org

ANNEX V: KEY THREATS TO BIODIVERSITY

PART I: Description of Somalia's Eco-systems

I. Terrestrial Ecosystems

I.1 Rangelands

Rangelands are the predominant ecosystem type in Somalia. Rangeland ecosystems in areas that receive very little rainfall (less than 400 mm) are home to annual grass and shrub species (IUCN, 2006). These areas function as wet season grazing for pastoralists. Rangeland ecosystems in areas that receive higher levels of rainfall (above 400mm) are dominated by perennial grass and shrub species, open woods and bush lands (IUCN, 2006); these areas were traditionally preserved for dry season grazing to give them time to recover and to serve as safety nets for livestock during dry seasons and drought (Cassinelli, 1986). The break in grazing of herds was crucial to allowing plant species to seed and regenerate. Most of dry season grazing reserves are now degraded and perennial species have been replaced by annuals (IUCN, 2006; Awale and Sugulle, 2011).

Somalia's rangelands are composed of several eco-regions, these are described below:

Tropical and subtropical grasslands, savannas, and shrub lands

The arid Northern regions of the country include the eastern and western plateaus that make up the Mudug plain and the Hawd respectively. The northernmost portion of the Mudug plain (Oogo region) harbors the Nugaal valley, a long and broad area of land that has an extensive network of seasonal watercourses that are traditional water sources during the wet seasons (Njoku, 2013). To the west is the Haud region, an area that comprises prime grazing lands that were traditionally dry season grazing reserves. The Hawd south of Hargeysa consists of stands of acacia underlain by grass species that are prized as livestock forage (Awale and Sugulle, 2011). Together these form a distribution pattern known as 'tiger bush' (Oroda, Oduori and Vargas, 2007). This is a feature that is currently disappearing from rangelands as the Acacia populations are under immense pressure from charcoal production (Government of the Federal Republic of Somalia and UN Somalia, 2013).

Deserts and xeric shrub lands

The northern coastal strip of Somalia (known as Guban under the Somali classification system) – an area that varies in width from two to twelve kilometers - runs parallel to the Gulf of Aden and forms part of the Ethiopian xeric grasslands and shrub lands eco-region. Water availability in this area is restricted to shallow watercourses that are completely rain-fed; Guban provides limited grazing for pastoralist communities.

A separate strip of grass and shrub lands in the south that runs along the Indian Ocean also serves as rangelands for pastoralists. The Hobyo grasslands and shrub lands eco-region that starts from Hobyo in south central Somalia and runs southwest to Mogadishu. Overgrazing in this area has resulted in deforestation and the intrusion of sand dunes inland. The original flora of this coast contained a number of endemic species that form part of the Somali-Maasai regional center of endemism (Friis, 1992, Davis et al. 1994, Lovett and Friis 1996 cited in WWF, 2014a). Species found here included the Silver Dik-dik (*Madoqua piacentinii*), and the Somali golden mole (*Calcochloris tytonis*), two species of reptile, *Haackgreerius miopus* and *Latastia cherkii* and two birds, Ash's Lark (*Mirafra ashi*) and the Obbia Lark (*Spizocorys obbiensis*) (WWF, 2014a).

The Somali Traditional ecological classification system, deegaan

Under the traditional system of ecological classification, 16 categories are recognized (Barkhadle, 1993 cited in UNEP, 2005):

Guban – “burnt area” in Somalia language – land (Dhulka Guban)
Buraha – mountain – land (Dhulka Buuraleyoy)
Hawd – bush or thicket – land (Dhulka Hawd)
Daror – large plain – land (Dhulka Dharoor)
Sol – a highland area – land (Dhulka Sool)
Nugal – a specific valley – land (Dhulka Nugaal)
Mudug – much of central Somalia – land (Dhulka Mudug)
lid – named after the yicib plant – land (Dhulka Ciid)
Deh – without high shrubs or trees – land (Dhulka Deexda)
Doboy – clay – land (Dhulka Dhobooy)
Bakol – an area where Commiphora trees dominate – land (Dhulka Bakool)
Gedo – land only suitable for animal (especially camel) grazing – land (Dhulka Gedo)
Bay – the area which receives the highest rainfall – land (Dhulka Baay)
Adele – flat area with small mountains – land (Dhulka Adeleh)
Doy – between the two banks of the Jubba and Shabeelle rivers – land (Dhulka Dooy)
Wamo – land lying between Badhaadhe and Kismayo and from Kismayo to the Kenyan border – land (Dhulka Waamo)

1.2 Forests

Somalia has minimal closed forest cover, at only 2.4 percent of the country (IUCN, 1992 cited in IUCN, 2006). The *Juniperus* mist forests of Gaan Libax in Somaliland are the only true forested areas of Somalia and are important centers of biological diversity and species endemism (UNEP, 2005). In addition to *Juniperus procera*, the forest is home to *Buxus hilderbrandtii*, *Euphorbia grandis*, *Olea africana*, *Ficus* sp., *Sideroxylon buxifolium*, *Euclea schimperi*, *Cadida purpurea*, *Acokanthera schimperi*, *Dodonea viscosa*, and *Draceana ombet*. The forest is also an important route for migratory birds (Awale, A. I., 2007)

Other *Juniperus* forests and tracts of *Boswellia* and *Commiphora* trees in the mountains to the North of the country together make up 12 percent of the total land area in Somalia (IUCN, 2006). Coastal forests in the South form part of the Northern Zanzibar-Inhambane Coastal Forest Mosaic eco-region, an eco-region that harbors densities of plant species that are among the highest in the world; levels of plant species endemism are also high (WWF, 2014). The northern margin of the Coastal Forest Mosaic is an isolated forest outlier along the Jubba Valley in central Somalia (Madgwick 1988 cited in WWF, 2014); parts of southern Somalia also form part of this eco-region, which extends then into northern Kenya (WWF, 2014).

Tropical floodplain forests along the Juba and Shabelle rivers are almost completely denuded due to land conversion. Smallholder agriculture, harvesting of firewood and timber and commercial banana and sugar plantations established under colonial rule have turned these areas into salt marsh ecosystems (IUCN, 2006). The most recent assessment of the areas (2006) showed that only Middle Juba retains significant floodplain forests (IUCN, 2006). This has been attributed to the relatively inaccessibility of the area and the water logged, saline nature of the soil that discourages agriculture. Floodplain forests provide habitat for a comparatively higher number of plant and animal species as compared to the surrounding shrub and bush lands (Madgwick, 1989 cited in IUCN, 2006).

2. Marine Ecosystems

Somalia's marine ecosystems form part of the Somali Current Marine Ecosystem; this extends from the Comoros Islands to Somalia (Mann and Lazier, 2006). It is an extremely productive ecosystem with one

of the most intense seasonal upwelling coastal systems in the world (Mann and Lazier, 2006). Well developed reefs are predominately found along the Southern Coast and the adjacent Bajuni Islands (Spalding, McManus and Jameson, 1995), however, there are also coral reefs in the Gulf of Aden. Red Sea coral reefs that are found of the coast of Djibouti, Somalia and Yemen have 30 to 50 percent live coral and are home to a high diversity of coral and attendant reef species Ocean (Pilcher and Alsuhaibany, 2000 cited in UNEP, 2005).

2.1 Mangroves

Isolated mangroves stands can be found along the Juba River and along the coast of Somalia in estuaries west of Bossaso and north of the Kenyan border (Hughes and Hughes, 1992 cited in UNEP, 2005; FAO, 2005). Mangrove ecosystems in Somalia form part of the East African mangroves eco-region, a series of swamps that are found along the Indian Ocean Coast from southern Somalia to Southern Mozambique (WWF, 2014b). Harvesting of mangroves for construction has negatively impacted the health of these ecosystems, affecting their capacity to serve as breeding areas for marine species (UNEP, 2005). Species of mangrove found in Somalia include *Avicennia marina*, *Bruguiera gymnorhiza*, *Ceriops somalensis*, *Ceriops tagal*, *Lumnitzera racemosa*, *Rhizophora mucronata*, *Sonneratia alba* and *Xylocarpus granatum* (FAO, 2005)

PART II: Threats to biodiversity

The table below presents the key threats to biodiversity and their causes using the threats-based approach to biodiversity conservation as the framework of analysis (USAID, 2005).

Biodiversity in Somalia is under pressure from four of the five main categories of direct threats to biodiversity as follows:

- i. Conversion, loss, degradation, and fragmentation of natural habitats
- ii. Overharvesting or overexploitation of particular species
- iii. Invasive non-native species that harm native ecosystems or species
- iv. Pollution or contamination that harms natural habitats or species

It is highly probable that biodiversity in the country is also under threat from climate change effects that harm habitats or species but there are no studies to support this assertion so the table below focuses on the first four categories.

Ecosystem	Threats	Causes
Rangelands	Habitat loss, degradation and fragmentation from: <ul style="list-style-type: none"> • Overgrazing • Wind and water erosion • Illegal charcoaling 	<ul style="list-style-type: none"> • Sedentarization; • Enclosures for fodder production; • Unregulated construction of cisterns and water pans • Lucrative market for charcoal export to Gulf States; • Loss of traditional, sustainable natural resource management practices; • High levels of poverty amongst rural communities; • Lack of alternative livelihood options;

		<ul style="list-style-type: none"> • Conflict; • Weak implementation and enforcement of environmental policies.
	<p>Overharvesting or overexploitation of particular species from:</p> <ul style="list-style-type: none"> • Illegal charcoaling of <i>Acacia</i> spp. 	<ul style="list-style-type: none"> • High levels of poverty amongst rural communities; • Lack of alternative livelihood options; • Conflict; • Lucrative market for charcoal export to Gulf States; • Loss of traditional, sustainable natural resource management practices; • Weak implementation and enforcement of environmental policies.
	<p>Invasive non-native species that harm native ecosystems from:</p> <ul style="list-style-type: none"> • Expansion of <i>Prosopis</i> spp and <i>Optunia</i> spp into habitats previously populated by <i>Acacia</i> spp 	<ul style="list-style-type: none"> • Overgrazing; • Illegal charcoaling; • No systems to control the spread of invasive species.
Forests	<p>Conversion of natural habitats from:</p> <ul style="list-style-type: none"> • Shifting cultivation • Expansion of agriculture into forested areas 	<ul style="list-style-type: none"> • Conflict; • Poor systems for land tenure in the South; • No systems for sustainable agriculture.
	<p>Overharvesting or overexploitation of particular species from:</p> <ul style="list-style-type: none"> • Illegal charcoaling 	<ul style="list-style-type: none"> • Conflict; • High levels of poverty amongst rural communities; • Lack of alternative livelihood options; • Lucrative market for charcoal export to Gulf States.
Marine	<p>Habitat and species loss, degradation and fragmentation from:</p> <ul style="list-style-type: none"> • Illegal fishing • Destructive fishing methods 	<ul style="list-style-type: none"> • No comprehensive assessment of coastal resources • No systems for sustainable fisheries • No regulation of fisheries sector • Unrestricted access to Somalia's marine areas
	<p>Pollution or contamination from:</p>	<ul style="list-style-type: none"> • Poor systems for waste management

	<ul style="list-style-type: none"> • Dumping of urban waste including liquid, industrial and medical waste into the oceans • Offshore dumping 	<ul style="list-style-type: none"> • Unrestricted access to Somalia's marine and coastal areas
Mangroves	Habitat and species loss, degradation and fragmentation from: <ul style="list-style-type: none"> • Construction • Carpentry 	<ul style="list-style-type: none"> • Unrestricted access to Somalia's marine and coastal areas • Weak implementation and enforcement of environmental policies

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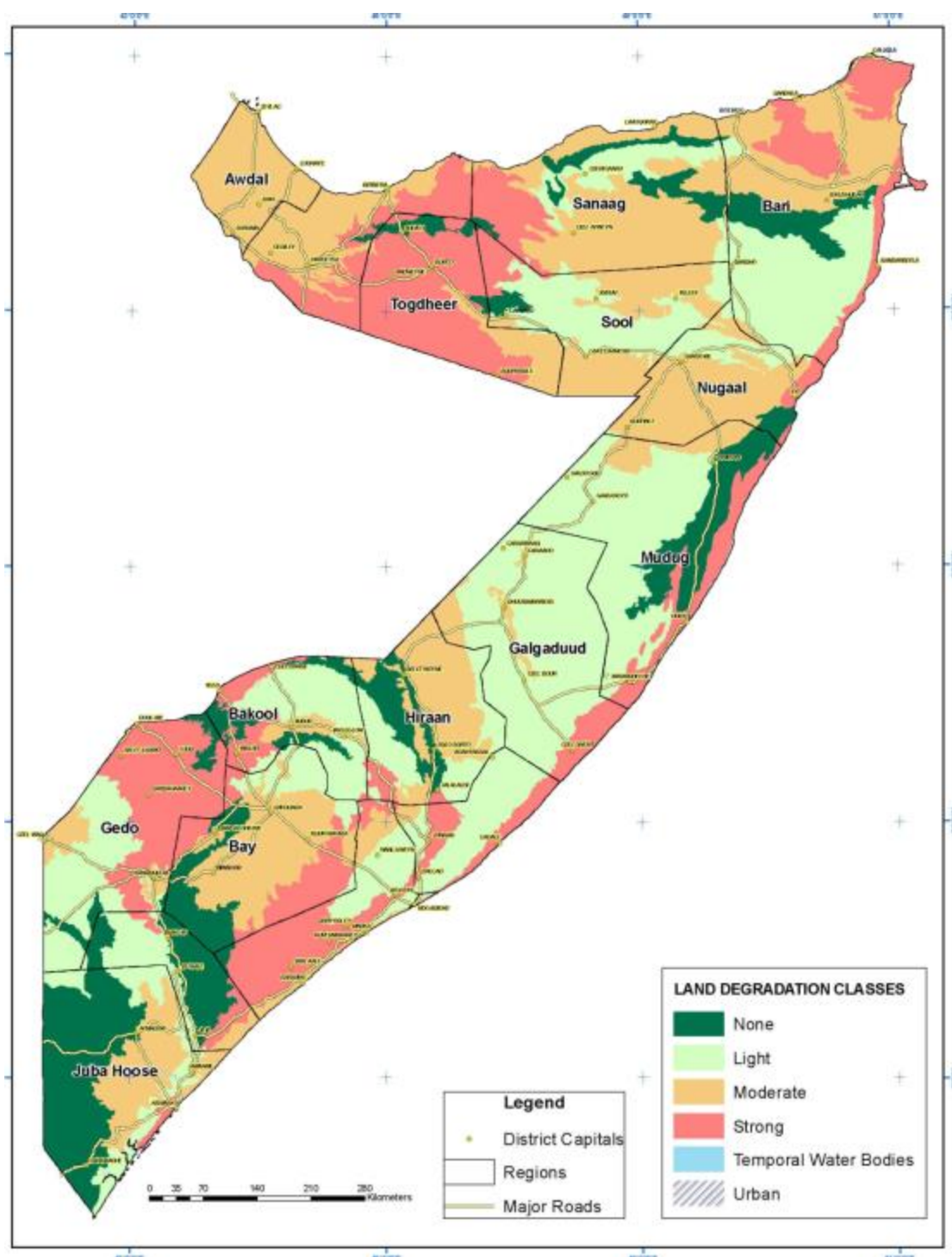
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ANNEX VI: MAP OF DEGRADED AREAS



Source: Omuto, Vargas and Alim (2009)

ANNEX VII: FOSSIL FUELS AND ALTERNATIVE ENERGY

a. Fossil Fuels

Somalia and Somaliland use fossil fuel to meet energy demands for lighting and industrial use. As with the charcoal industry, the electric utility sector is poorly regulated; power in urban areas is supplied almost entirely by the private sector. The cost of energy in Somalia and Somaliland ranges from USD 1.00 to \$1.50 per kilowatt hour making Somalia it one of the most expensive places to buy energy in the world³⁰(Arte, 2014). Small businesses and service providers in Mogadishu spends almost 26% of their income on energy (Balla, 2013) making electricity a significant limiting factor to industrial development across Somalia. The cost to households is just as high; an analysis of the energy sector in Mogadishu estimates that on average, households pay between US\$ 19-36 per month depending on the usage, after paying exorbitant connection costs of between one hundred and fifty to three hundred dollars (Balla, 2013). Given the high cost, on average only about 30% of urban households use electricity (Arte, 2014) with a per capita consumption of between 20 and 30 kWh per month (Balla, 2013).

Electricity supply in Somalia and Somaliland has several problems that stem from serious regulatory gaps. Without standards for safety, price and efficiency, the industry is mainly characterized by irregular power supply, low capacity utilization, poor maintenance and safety practices, and high transmission and distribution losses (Balla, 2013; Arte, 2014). Power losses have been estimated at an average of 40% (Arte, 2014). This is more than four times the international standard of 10-12% (Balla, 2013). This drives the high cost of electricity and contributes to greenhouse gas emissions.

The Promotion of Economic Growth program has made some gains in addressing gaps in power supply in Hargeisa through two activities. One is the pilot wind farm at the airport and the other is the drafting of a regulatory framework for the industry. There have also been requests from the private sector for help in developing efficiency guidelines, designing systems and training staff; this will be crucial in supporting compliance to the new policy.

b. Alternative energy

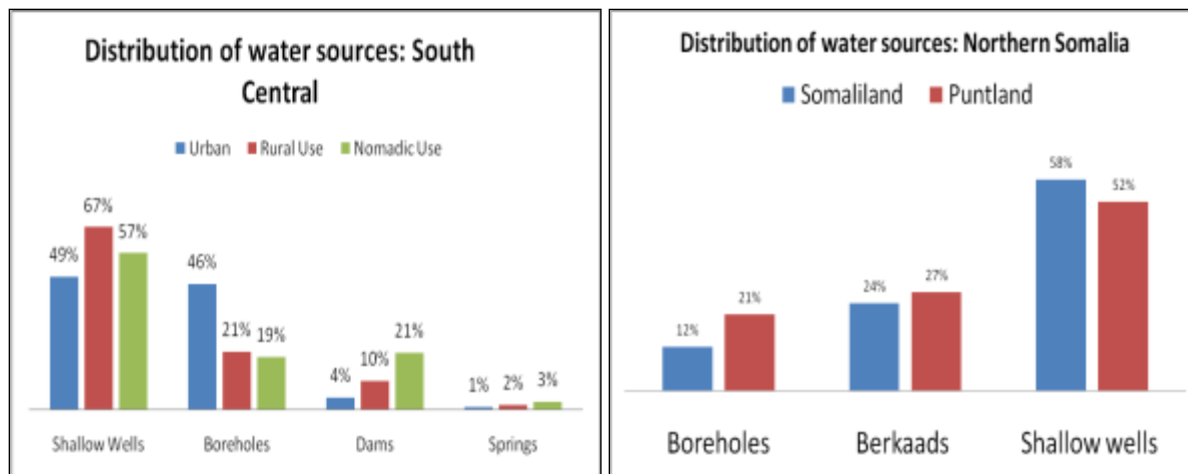
Somalia has an untapped potential for year round supply of renewable energy, particularly wind and solar. Average wind speed in northern Somalia is 0.2 to 8.5m/sec (Muchiri, 2007). Hargeisa has the highest wind speeds, with an average of 17 m/sec³¹ in the month of July (Muchiri, 2007). A four wind turbine pilot implemented by PEGS is currently generating 80-100kw which meets the energy requirements of the Hargeisa airport and has surplus that is fed into the grid (Arte, 2014). The turbines are saving 175 liters of diesel per day (Arte, 2014). Based on the success of the pilot, it is estimated that wind energy can provide almost 50% of the city's energy needs (Arte, 2014). Given the high cost of fossil fuels in Somalia the economics of renewables will be favorable over the long-term as other barriers (security, rule of law) are reduced.

³⁰This is almost ten times more than the cost per kilowatt hour in Kenya and five times the cost for Djibouti.

³¹Utility-scale wind power plants require minimum average wind speeds of 6 m/s. <http://setis.ec.europa.eu/setis-deliverables/technology-mapping/technology-map-chapters-2011/wind-power-generation>

ANNEX VII: WATER SOURCES

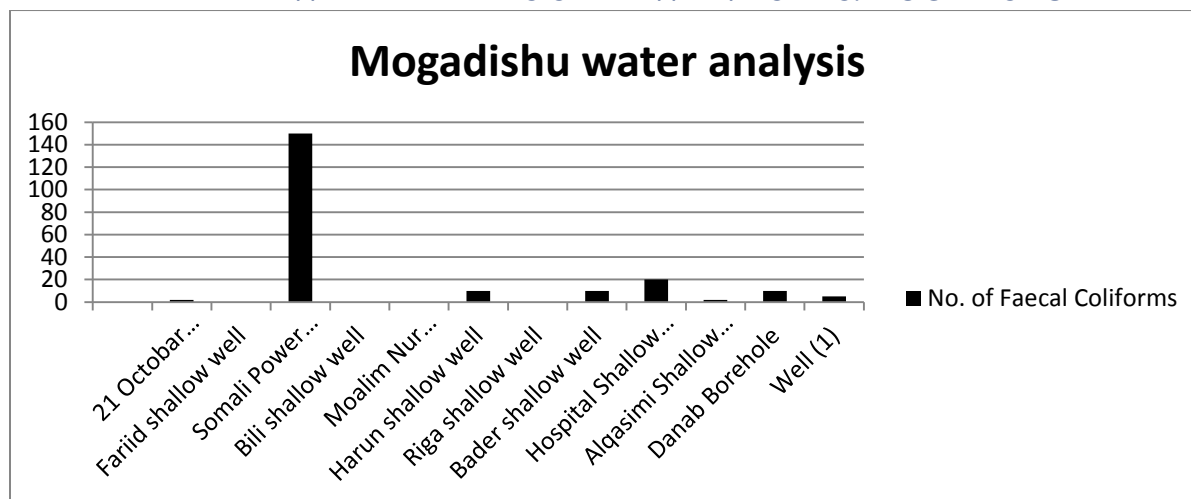
REGIONAL DISTRIBUTION OF WATER SOURCES



SOURCE: FAO AQUASTAT, 2013

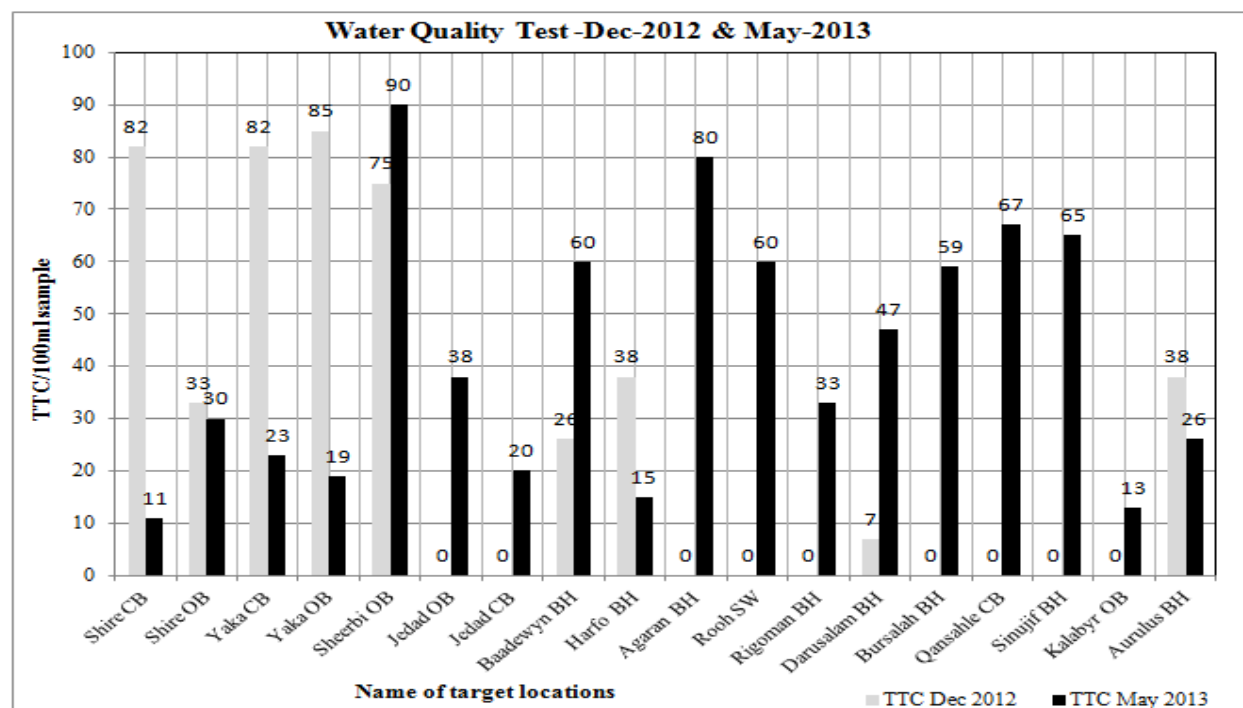
ANNEX IX: WATER ANALYSIS CHARTS

WATER ANALYSIS AT TWELVE SITES: MOGADISHU



SOURCE: HIJRA, 2014

WATER QUALITY ANALYSIS AT 18 SITES ACROSS PUNTLAND



Source: CARE Somalia, 2013

ANNEX X: 2006 IUCN RED LIST FOR SOMALIA

Major Group	Family	Species Name	English Common Name	Red List Category, & Criteria
	Mobulidae	<i>Mobula eregoodootenkee</i> (Bleeker, 1859)	Pygmy Devilray	NT
	Mobulidae	<i>Mobula japanica</i> (Müller & Henle, 1841)	Devilray, Japanese Devilray, Spinetail Devilray, Spinetail Mobula	NT
	Myliobatidae	<i>Aetobatus narinari</i> (Euphrasen, 1790)	Bonnetray, Maylan, Spotted Eagle Ray	NT
	Odontaspidae	<i>Carcharias taurus</i> Rafinesque, 1810	Grey Nurse Shark, Sand Tiger Shark, Spotted Ragged-tooth Shark	VU A1ab+2d
	Pegasiidae	<i>Eurypegasus draconis</i> (Linnaeus, 1766)	Little Dragonfish, Short Dragonfish	DD
	Pristidae	<i>Anoxypristis cuspidata</i> (Latham, 1794)	Knifetooth Sawfish, Narrow Sawfish, Pointed Sawfish	CR A2bcd+3cd+4bcd
	Pristidae	<i>Pristis pectinata</i> Latham, 1794	Smalltooth, Wide Sawfish	CR A2bcd+3cd+4bcd
	Pristidae	<i>Pristis zijsron</i> Bleeker, 1851	Narrowmouth Sawfish	CR A2bcd+3cd+4bcd
	Rhincodontidae	<i>Rhincodon typus</i> Smith, 1828	Whale Shark	VU A1bd+2d
	Rhinidae	<i>Rhina ancylostoma</i> Bloch & Schneider, 1801	Bowmouth Guitarfish, Mud Skate, Shark Ray	VU A2bd+3bd+4bd
	Rhinobatidae	<i>Rhinobatos thoin</i> (Anonymous, 1798)	Clubnose Guitarfish	VU A2abd+3bd+4abd
	Rhinopteridae	<i>Rhinoptera javanica</i> Müller & Henle, 1841	Flapnose Ray, Javanese Cownose Ray	VU A2d+3cd+4cd
	Rhinochimaeridae	<i>Neoharriotta pumila</i> Didier & Stehmann, 1996	Arabian Sicklefin Chimaera	DD
	Rhynchobatidae	<i>Rhynchobatus djiddensis</i> (Forsskal, 1775)	Giant Guitarfish, Whitespotted Wedgefish	VU A2d+3d+4d
	Scombridae	<i>Thunnus alalunga</i> (Cetti, 1777)	Albacore Tuna	DD
	Scombridae	<i>Thunnus obesus</i> (Lowe, 1839)	Bigeye Tuna	VU A1bd
	Scyliorhinidae	<i>Bythaelurus lutarius</i> (Springer & D'Aubrey, 1972)	Brown Catshark, Mud Catshark	DD
	Serranidae	<i>Dermatolepis striolata</i> (Playfair, 1867)	Smooth Grouper	DD
	Serranidae	<i>Epinephelus coioides</i> (Hamilton, 1822)	Estuary Cod, Orange-spotted Grouper	NT
	Serranidae	<i>Epinephelus fasciatus</i> (Forsskal, 1775)	Brown-Marbled Grouper	NT
	Serranidae	<i>Epinephelus lanceolatus</i> (Bloch, 1790)	Brindle Bass, Brindled Grouper, Giant Grouper, Queensland Groper	VU A2d
	Serranidae	<i>Epinephelus malabaricus</i> (Bloch & Schneider, 1801)	Malabar Grouper	NT
	Serranidae	<i>Epinephelus polyphekadion</i> (Bleeker, 1849)	Camouflage Grouper	NT
	Sphyrnidae	<i>Sphyrna lewini</i> (Griffith & Smith, 1834)	Scalloped Hammerhead	LR/nt
	Sphyrnidae	<i>Sphyrna mokarran</i> (Rüppell, 1837)	Great Hammerhead	DD
	Torpedinidae	<i>Torpedo panthera</i> Olfers, 1831	Leopard Torpedo	DD
	Torpedinidae	<i>Torpedo sinuspersici</i> Olfers, 1831	Gulf Torpedo, Marbled Electric Ray	DD
	Xiphiidae	<i>Xiphias gladius</i> Linnaeus, 1758	Swordfish	DD
Animals: Frogs	Bufonidae	<i>Bufo langanoensis</i> Largen, Tandy & Tandy, 1978		DD
	Ranidae	<i>Lanzarana largeni</i> (Lanza, 1978)		NT
	Ranidae	<i>Ptychoadena fitwaha</i> Largen, 1997		DD
Animals: Birds	Accipitridae	<i>Circus fasciolatus</i> Kaup, 1850	Southern Banded Snake-eagle	NT
	Accipitridae	<i>Circus macrourus</i> (Gmelin, 1770)	Pollid Harrier	NT
	Accipitridae	<i>Torgos tracheliotos</i> (Forster, 1791)	Lappet-faced Vulture	VU C1
	Alaudidae	<i>Heteromirafra archeri</i> Clarke, 1920	Archer's Lark	CR B1ab(iii,v); C2a(ii)
	Alaudidae	<i>Mirafra ashi</i> Colston, 1982	Ash's Lark	EN B1ab(i,ii,iii,v)
	Alaudidae	<i>Spizocorys obbiensis</i> Whiterby, 1905	Obbia Lark	DD
	Ardeidae	<i>Ardeola idae</i> (Hartlaub, 1860)	Madagascar Pond-heron	EN C2a(ii)
	Charadriidae	<i>Vanellus gregarius</i> (Pallas, 1771)	Sociable Lapwing	CR A3bc
	Cisticolidae	<i>Cisticola restrictus</i> T aylor, 1967	Tana River Cisticola	DD
	Columbidae	<i>Columba oliviae</i> Clarke, 1918	Somali Pigeon	DD
	Columbidae	<i>Streptopelia reichenowi</i> (Erlanger, 1901)	White-winged Collared-dove	NT
	Coraciidae	<i>Coracias garrulus</i> Linnaeus, 1758	European Roller	NT

Major Group	Family	Species Name	English Common Name	Red List Category, & Criteria
	Falconidae	<i>Falco naumanni</i> Fleischer, 1818	Lesser Kestrel	VU A2bc+3bc
	Falconidae	<i>Falco vespertinus</i> Linnaeus, 1766	Red-footed Falcon	NT
	Fringillidae	<i>Carduelis johannis</i> (Clarke, 1919)	Warsangli Linnet	EN B1ab(iii), C2a(ii)
	Glareolidae	<i>Glareola nordmanni</i> Fischer, 1842	Black-winged Pratincole	NT
	Glareolidae	<i>Glareola ocularis</i> Verreaux, 1833	Madagascar Pratincole	VU C1
	Hydrobatidae	<i>Oceanodroma matsudairae</i> Kuroda, 1922	Matsudaira's Storm-Petrel	DD
	Laridae	<i>Larus leucophthalmus</i> Temminck, 1825	White-eyed Gull	NT
	Laridae	<i>Rynchops flavirostris</i> Vieillot, 1816	African Skimmer	NT
	Malaconotidae	<i>Laniarius liberatus</i> Smith, Arctander, Fjeldså & Amir, 1991	Bulo Burti Boubou	CR D
	Motacillidae	<i>Anthus melindae</i> Shelley, 1900	Malindi Pipit	NT
	Muscicapidae	<i>Cercomela dubia</i> (Blundell & Lovat, 1899)	Sombre Chat	DD
	Muscicapidae	<i>Ficedula semitorquata</i> (Homeyer, 1885)	Semicollared Flycatcher	NT
	Musophagidae	<i>Tauraco fischeri</i> (Reichenow, 1878)	Fischer's Turaco	NT
	Otididae	<i>Eupodotis humilis</i> (Blyth, 1856)	Little Brown Bustard	NT
	Phalacrocoracidae	<i>Phalacrocorax nigrogularis</i> Ogilvie-Grant & Forbes, 1899	Socotra Cormorant	VU A2ce+3ce, B2ab(i,ii,iii,iv,v)
	Phoenicopteridae	<i>Phoenicopterus minor</i> Geoffroy Saint-Hilaire, 1798	Lesser Flamingo	NT
	Procellariidae	<i>Bulweria fallax</i> Jouanin, 1955	Jouanin's Petrel	NT
	Rallidae	<i>Crax crax</i> (Linnaeus, 1758)	Corncrake	NT
	Scolopacidae	<i>Gallinago media</i> (Latham, 1787)	Great Snipe	NT
	Scolopacidae	<i>Limosa limosa</i> (Linnaeus, 1758)	Black-tailed Godwit	NT
	Sylviidae	<i>Acrocephalus griseldis</i> (Hartlaub, 1891)	Basra Reed-warbler	EN A2bc+3bc
	Sylviidae	<i>Sylvietta philippae</i> Williams, 1955	Short-billed Crombec	DD
	Threskiornithidae	<i>Geroniscus eremita</i> (Linnaeus, 1758)	Northern Bald Ibis	CR C2a(ii)
	Turdidae	<i>Turdus ludoviciae</i> (Phillips, 1895)	Somali Thrush	CR A2c+3c
Animals: Mammals	Bovidae	<i>Alcelaphus buselaphus</i> (Pallas, 1766)	Common Hartebeest, Hartebeest	LR/cd
	Bovidae	<i>Ammodorcas clarkei</i> (Thomas, 1891)	Clarke's Gazelle, Dibatag	VU C1
	Bovidae	<i>Beatragus hunteri</i> (P.L. Slater, 1889)	Hurola, Hunter's Antelope, Hunter's Hartebeest	CR A1a
	Bovidae	<i>Cephalophus harveyi</i> (Thomas, 1893)	Harvey's Duiker, Harvey's Red Duiker	LR/cd
	Bovidae	<i>Damaliscus lunatus</i> (Burchell, 1823)	Tsessebe	LR/cd
	Bovidae	<i>Dorcatragus megalotis</i> (Menges, 1894)	Beira Antelope, Beira	VU C1
	Bovidae	<i>Gazella dorcas</i> (Linnaeus, 1758)	Dorcas Gazelle	VU A1a
	Bovidae	<i>Gazella granti</i> Brooke, 1872	Grant's Gazelle	LR/cd
	Bovidae	<i>Gazella soemmerringii</i> (Cretzschmar, 1826)	Soemmerring's Gazelle	VU C1
	Bovidae	<i>Gazella spekei</i> Blyth, 1863	Speke's Gazelle	VU C1
	Bovidae	<i>Kobus ellipsiprymnus</i> (Ogilby, 1833)	Waterbuck	LR/cd
	Bovidae	<i>Liotocranius walleri</i> (Brooke, 1879)	Gerenuk	LR/cd
	Bovidae	<i>Madoqua piacentinii</i> Drake-Brockman, 1911	Silver Dik-dik	VU C1
	Bovidae	<i>Oreotragus oreotragus</i> (Zimmermann, 1783)	Klipspringer	LR/cd
	Bovidae	<i>Oryx gazella</i> (Linnaeus, 1758)	Gemsbok	LR/cd
	Bovidae	<i>Ourebia ourebi</i> (Zimmermann, 1783)	Oribi	LR/cd
	Bovidae	<i>Syncerus caffer</i> (Sparrman, 1779)	African Buffalo	LR/cd

Major Group	Family	Species Name	English Common Name	Red List Category, & Criteria
	Bovidae	<i>Tragelaphus imberbis</i> (Blyth, 1869)	Lesser Kudu	LR/cd
	Bovidae	<i>Tragelaphus strepsiceros</i> (Pallas, 1766)	Greater Kudu	LR/cd
	Canidae	<i>Vulpes rueppelli</i> (Schinz, 1825)	Rüppell's Fox, Rüppell's Fox, Rüppell's Sand Fox, Sand Fox	DD
	Cercopithecidae	<i>Papio hamadryas</i> (Linnaeus, 1758)	Hamadryas Baboon, Sacred Baboon	LR/nt
	Chrysochloridae	<i>Calochloris tytonis</i> (Simonetta, 1968)	Somali Golden Mole	DD
	Ctenodactylidae	<i>Pectinator spekei</i> Blyth, 1856	Speke's Pectinator	DD
	Delphinidae	<i>Feresa attenuata</i> Gray, 1874	Pygmy Killer Whale, Slender Blackfish	DD
	Delphinidae	<i>Lagenodelphis hosei</i> Fraser, 1956	Fraser's Dolphin, Sarawak Dolphin	DD
	Delphinidae	<i>Sousa chinensis</i> (Osbeck, 1765)	Chinese White Dolphin, Indo-Pacific Humpbacked Dolphin	DD
	Delphinidae	<i>Stenella longirostris</i> (Gray, 1828)	Long-Beaked Dolphin, Long-snouted Dolphin, Spinner Dolphin	LR/cd
	Delphinidae	<i>Steno bredanensis</i> (G. Cuvier in Lesson, 1828)	Rough-Toothed Dolphin	DD
	Delphinidae	<i>Tursiops aduncus</i> (Ehrenberg, 1833)	Indian Ocean Bottlenose Dolphin, Indo-Pacific Bottlenose Dolphin	DD
	Dugongidae	<i>Dugong dugon</i> (Müller, 1776)	Dugong, Sea Cow	VU A2bcd
	Elephantidae	<i>Loxodonta africana</i> (Blumenbach, 1797)	African Elephant	VU A2a
	Emballonuridae	<i>Taphozous hamiltoni</i> Thomas, 1920	Hamilton's Tomb Bat	NT
	Equidae	<i>Equus africanus</i> (Heuglin & Fitzinger, 1866)	African Ass, African Wild Ass, Ass	CR A1b
	Equidae	<i>Equus grevyi</i> Oustalet, 1882	Grevy's Zebra	EN A1a+2c
	Felidae	<i>Acinonyx jubatus</i> (Schreber, 1775)	Cheetah, Hunting Leopard	VU C2a(f)
	Felidae	<i>Panthera leo</i> (Linnaeus, 1758)	African Lion, Lion	VU A2abcd
	Galagonidae	<i>Galago gallarum</i> Thomas, 1901	Somali Galago, Somali Lesser Galago	LR/nt
	Galagonidae	<i>Galago zanzibaricus</i> Matschie, 1893	Matundu Dwarf Galago, Zanzibar Bushbaby, Zanzibar Galago	LR/nt
	Giraffidae	<i>Giraffa camelopardalis</i> (Linnaeus, 1758)	Giraffe	LR/cd
	Hippopotamidae	<i>Hippopotamus amphibius</i> Linnaeus, 1758	Common Hippopotamus, Hippopotamus, Large Hippo	VU A4cd
	Hipposideridae	<i>Hipposideros marungensis</i> Noack, 1887		NT
	Hipposideridae	<i>Hipposideros megalotis</i> (Heuglin, 1862)	Ethiopian Large-eared Roundleaf Bat	NT
	Hyaenidae	<i>Crocuta crocuta</i> (Erxleben, 1777)	Spotted Hyaena	LR/cd
	Hyaenidae	<i>Hyaena hyaena</i> (Linnaeus, 1758)	Striped Hyaena	LR/nt
	Macroscelididae	<i>Elephantulus revoilii</i> (Huet, 1881)	Somali Elephant Shrew, Somali Sengi	DD
	Manidae	<i>Manis temminckii</i> Smuts, 1832	Cape Pangolin, Ground Pangolin, Scaly Anteater, South African Pangolin, Temminck's Ground Pangolin	LR/nt
	Muridae	<i>Ammodillus imbellis</i> (de Winton, 1898)	Ammodile	DD
	Muridae	<i>Arvicanthis somalicus</i> Thomas, 1903	Somali Grass Rat	DD
	Muridae	<i>Gerbillus acticola</i> Thomas, 1918	Berbera Gerbil	DD
	Muridae	<i>Gerbillus brockmani</i> (Thomas, 1910)	Brockman's Gerbil	DD
	Muridae	<i>Gerbillus dunni</i> Thomas, 1904	Somalia Gerbil	DD
	Muridae	<i>Gerbillus rosalia</i> St Leger, 1929	Rosalinda Gerbil	DD
	Muridae	<i>Gerbillus somalicus</i> (Thomas, 1910)	Somalian Gerbil	DD
	Muridae	<i>Grammomys caniceps</i> Hutterer & Dieterlen, 1984	Gray-Headed Thicket Rat	DD
	Nycteridae	<i>Nycteris aurita</i> Andersen, 1912		DD
	Nycteridae	<i>Nycteris parisi</i> de Beaux, 1924	Parisi's Slit-faced Bat	DD
	Rhinolophidae	<i>Rhinolophus blasii</i> Peters, 1866	Blasius's Horseshoe Bat	NT
	Rhinolophidae	<i>Rhinolophus eloquenti</i> K. Andersen, 1905	Eloquent Horseshoe Bat	DD
	Rhinopomatidae	<i>Rhinopoma macinnesi</i> Hayman, 1937	Macinnes's Mouse-tailed Bat	VU D1

Major Group	Family	Species Name	English Common Name	Red List Category, & Criteria
	Soricidae	<i>Crocidura nana</i> Dobson, 1890	Dwarf White-Toothed Shrew	DD
	Vespertilionidae	<i>Hypsugo eisenbrauti</i> (Hill, 1968)	Eisenbraut's Pipistrelle	DD
	Vespertilionidae	<i>Neoromicia helios</i> (Heller, 1912)	Heller's Pipistrelle	DD
	Vespertilionidae	<i>Scotoecus albigula</i> Thomas, 1909	White-bellied Lesser House Bat	DD
	Vespertilionidae	<i>Scotoecus hindei</i> Thomas, 1901	Hinde's Lesser House Bat	DD
	Vespertilionidae	<i>Scotoecus hirundo</i> de Winton, 1899	Dark-winged Lesser House Bat	DD
	Viverridae	<i>Genetta abyssinica</i> (Rüppell, 1836)	Abyssinian Genet	DD
	Ziphiidae	<i>Indopacetus pacificus</i> (Longman, 1926)	Indo-Pacific Beaked Whale, Longman's Beaked Whale	DD
	Ziphiidae	<i>Mesoplodon densirostris</i> (Blainville, 1817)	Blainville's Beaked Whale	DD
	Ziphiidae	<i>Mesoplodon ginkgodens</i> Nishiwaki & Kamiya, 1958	Ginkgo-toothed Beaked Whale	DD
Animals: Tortoises & Turtles	Cheloniidae	<i>Chelonia mydas</i> (Linnaeus, 1758)	Green Turtle	EN A2bd
	Cheloniidae	<i>Eretmochelys imbricata</i> (Linnaeus, 1766)	Hawksbill Turtle	CR A1bd
	Testudinidae	<i>Geochelone sulcata</i> (Miller, 1779)	African Spurred Tortoise, Grooved Tortoise	VU A1cd
Animals: Snails	Ampullaridae	<i>Pila speciosa</i> Philippi, 1849		VU B1+2bc
	Neritidae	<i>Neritina natalensis</i> Reeve		DD
Plants: Conifers	Cupressaceae	<i>Juniperus procera</i> Hochst. ex Endl.	African Pencil Cedar, East African Cedarwood	LR/nt
Plants: Flowering Plants	Aloaceae	<i>Aloe emininz</i> Reynolds & Bally		LR/nt
	Anacardiaceae	<i>Pistacia aethiopica</i> Kokwaro		LR/nt
	Boraginaceae	<i>Cordia obovata</i> Balf. f.		LR/nt
	Boraginaceae	<i>Cordia suchertii</i> Chiov.		LR/nt
	Burseraceae	<i>Boswellia sacra</i> Fleuckiger		LR/nt
	Burseraceae	<i>Commiphora alata</i> Chiov.		VU D2
	Burseraceae	<i>Commiphora albiflora</i> Engl.		LR/nt
	Burseraceae	<i>Commiphora chaetocarpa</i> J.B. Gillett		VU D2
	Burseraceae	<i>Commiphora ciliata</i> Vollesen		LR/nt
	Burseraceae	<i>Commiphora corrugata</i> J.B. Gillett & K. Vollesen		LR/nt
	Burseraceae	<i>Commiphora guidottii</i> Chiov.		LR/nt
	Burseraceae	<i>Commiphora hodai</i> Sprague		LR/nt
	Burseraceae	<i>Commiphora obovata</i> Chiov.		LR/nt
	Burseraceae	<i>Commiphora pseudopalauii</i> J.B. Gillett		LR/nt
	Burseraceae	<i>Commiphora sphaerophylla</i> Chiov.		LR/nt
	Burseraceae	<i>Commiphora sulcata</i> Chiov.		LR/nt
	Burseraceae	<i>Commiphora truncata</i> Engl.		LR/nt
	Burseraceae	<i>Commiphora unilobata</i> J.B. Gillett & K. Vollesen		LR/nt
	Combretaceae	<i>Conocarpus lancifolius</i> Engl. & Diels		LR/nt
	Dirachmaceae	<i>Dirachma somaliensis</i> D.A. Link		EN C2b, D
	Dracaenaceae	<i>Dracaena ombet</i> Kotschy & Peyr.		EN A1cd
	Ebenaceae	<i>Diospyros greenwayi</i> F. White		VU B1+2c
	Ebenaceae	<i>Diospyros wajirensis</i> F. White		LR/nt
	Euphorbiaceae	<i>Croton megalocarpoides</i> Friis & Gilbert		LR/nt
	Euphorbiaceae	<i>Croton talapoporos</i> R.-Sm.		LR/nt
	Euphorbiaceae	<i>Euphorbia noxia</i> Pax		VU D2
	Euphorbiaceae	<i>Euphorbia thulinii</i> S. Carter		VU D2

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	Leguminosae	<i>Acacia ankobib</i> Chiov.		LR/nt
	Leguminosae	<i>Acacia caraniana</i> Chiov.		LR/nt
	Leguminosae	<i>Acacia cernua</i> M.Thulin & A.S.Hassan		LR/nt
	Leguminosae	<i>Acacia condyloclada</i> Chiov.		LR/nt
	Leguminosae	<i>Acacia densispina</i> M.Thulin		VU B1+2c
	Leguminosae	<i>Acacia flagellaris</i> M.Thulin		VU B1+2c
	Leguminosae	<i>Acacia manubensis</i> J.H.Ross		VU B1+2c
	Leguminosae	<i>Acacia moggii</i> M.Thulin & M.Tardelli		LR/nt
	Leguminosae	<i>Acacia ochracea</i> M.Thulin & A.S.Hassan		LR/nt
	Leguminosae	<i>Acacia sarcophylla</i> Chiov.		LR/nt
	Leguminosae	<i>Adenopodia rotundifolia</i> (Harms) Brenan		VU B1+2c
	Leguminosae	<i>Albizia obbiadensis</i> (Chiov.) Brenan		VU B1+2c
	Leguminosae	<i>Cordauxia edulis</i> Hemsley		VU A2cd
	Leguminosae	<i>Cordyla somalensis</i> J.B.Gillett		LR/nt
	Leguminosae	<i>Dalbergia eremicola</i> Polh.		LR/nt
	Leguminosae	<i>Delonix baccal</i> (Chiov.) Baker f.		LR/nt
	Leguminosae	<i>Dialium orientale</i> Baker f.		LR/nt
	Leguminosae	<i>Dichrostachys kirkii</i> Benth.		LR/nt
	Leguminosae	<i>Dicraeopetalum stipulare</i> Harms		VU A2cd
	Leguminosae	<i>Lonchocarpus kanurii</i> Brenan & J.B.Gillett		LR/nt
	Leguminosae	<i>Newtonia erlangeri</i> (Harms) Brenan		LR/nt
	Leguminosae	<i>Parkinsonia raimondoi</i> Brenan		LR/nt
	Malvaceae	<i>Symphochlamys erlangeri</i> Guerke		LR/nt
	Palmae	<i>Livistona carinensis</i> (Chiov.) Dransf. & Uhl		VU B1+2c
	Rubiaceae	<i>Wendlandia arabica</i> DC.		LR/nt
	Sapotaceae	<i>Mimusops angel</i> Chiov.		LR/nt
	Sterculiaceae	<i>Hildegardia gillettii</i> L.J.Dorr & L.C.Barnett		EN C2b, D
	Sapindaceae	<i>Bottegia insignis</i> Chiov.		LR/nt
	Sapindaceae	<i>Camptolepis ramiflora</i> (Taub.) Radlk.		VU B1+2c
	Sapindaceae	<i>Haplocoelum trigonocarpum</i> Radlk.		LR/nt
	Umbelliferae	<i>Steganotaenia commiphoroides</i> M.Thulin		LR/nt

Major Group	Family	Species Name	English Common Name	Red List Category, & Criteria
Animals: Insects	Libellulidae	<i>Urothemis thomasi</i> Longfield, 1932		EN C2a(i)
Animals: Fish	Alopiidae	<i>Alopias vulpinus</i> (Bonnaterre, 1788)	Thresher Shark	DD
	Carcharhinidae	<i>Carcharhinus amblyrhynchoides</i> (Whitley, 1934)	Graceful Shark	LR/nt
	Carcharhinidae	<i>Carcharhinus amblyrhynchos</i> (Bleeker, 1856)	Gray Reef Shark	LR/nt
	Carcharhinidae	<i>Carcharhinus amboinensis</i> (Müller & Henle, 1839)	Java Shark, Piggye Shark	DD
	Carcharhinidae	<i>Carcharhinus brevipinna</i> (Müller & Henle, 1839)	Spinner Shark	LR/nt
	Carcharhinidae	<i>Carcharhinus leucas</i> (Müller & Henle, 1839)	Bull Shark	LR/nt
	Carcharhinidae	<i>Carcharhinus limbatus</i> (Valenciennes, 1839)	Blacktip Shark	LR/nt
	Carcharhinidae	<i>Carcharhinus longimanus</i> (Poey, 1861)	Oceanic Whitetip Shark, White-tipped Shark, Whitetip Oceanic Shark, Whitetip Shark	VU A2ad+3d+4ad
	Carcharhinidae	<i>Carcharhinus melanopterus</i> (Quoy & Gaimard, 1824)	Blacktip Reef Shark	LR/nt
	Carcharhinidae	<i>Carcharhinus plumbeus</i> (Nardo, 1827)	Sandbar Shark	LR/nt
	Carcharhinidae	<i>Galeocerdo cuvier</i> (Péron & Lesueur, 1822)	Tiger Shark	LR/nt
	Carcharhinidae	<i>Prionace glauca</i> (Linnaeus, 1758)	Blue Shark	LR/nt
	Carcharhinidae	<i>Scoliodon laticaudus</i> Müller & Henle, 1838	Spadenose Shark	LR/nt
	Carcharhinidae	<i>Triaenodon obesus</i> (Rüppell, 1837)	Whitetip Reef Shark	LR/nt
	Centrophoridae	<i>Centrophorus granulosus</i> (Bloch & Schneider, 1801)	Gulper Shark	VU A2abd+3d+4d
	Centrophoridae	<i>Centrophorus tessellatus</i> Garman, 1906	Mosaic Dogfish, Mosaic Gulper Shark	DD
	Clariidae	<i>Uegitlanis zammaranoi</i> Gianferrari, 1923		VU B1+2c
	Clariidae	<i>Pardiglanis tarabinii</i> Poll, Lanza & Romoli Sassi, 1972	Giant Catfish	DD
	Cyprinidae	<i>Barbopsis devechi</i> di Caporiacco, 1926		VU D2
	Cyprinidae	<i>Phreatichthys andruzzii</i> Vinciguerra, 1824		VU D2
	Dasyatidae	<i>Taeniura meyeni</i> Müller & Henle, 1841	Black-blotched Stingray, Black-spotted Stingray, Blotched Fantail Ray, Fantail Stingray, Giant Reef Ray, Round Ribbontail Ray, Speckled Stingray	VU A2ad+3d+4ad
	Dasyatidae	<i>Urogymnus asperrimus</i> (Bloch & Schneider, 1801)	Porcupine Ray	VU A1bd, B1+2bcd
	Ginglymostomatidae	<i>Nebrius ferrugineus</i> (Lesson, 1830)	Tawny Nurse Shark	VU A2abcd+3cd+4abcd
	Gymnuridae	<i>Gymnura poecilura</i> (Shaw, 1804)	Longtail Butterfly Ray	NT
	Hemigaleidae	<i>Hemipristis elongatus</i> Khunzinger, 1871	Fossil Shark, Snaggletooth Shark	VU A2bd+3bd+4bd
	Heterodontidae	<i>Heterodontus ramalheira</i> (Smith, 1949)	Whitespotted Bullhead Shark	DD
	Labridae	<i>Cheilinus undulatus</i> Rüppell, 1835	Giant Wrasse, Humphead Wrasse, Humphead, Maori Wrasse, Napoleon Wrasse, Truck Wrasse, Undulate Wrasse	EN A2bd+3bd
	Lamnidae	<i>Isurus paucus</i> Rafinesque, 1810	Shortfin Mako	LR/nt
	Mobulidae	<i>Manta birostris</i> (Dondorf, 1798)	Devil Fish, Devil Ray, Giant Manta, Manta Ray, Prince Alfred's Ray	NT

SOURCE: IUCN, 2006

ANNEX XI: INTERNATIONAL AGREEMENTS

Somalia is a signatory to the following environmental agreements:

- UN Framework Convention on Climate Change (UNFCCC) (Signed December 10th, 2009);
- Convention on Biological Diversity (CBD) (Signed January 9th 2012);
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Accepted December 2nd 1985);
- UN Convention on the Law of the Sea (Ratified July 24th, 1989);
- Convention on the Conservation of Migratory Species of Wild Animals (Ratified February 1st, 1986);
- Regional Convention for the Conservation of the Red Sea and the Gulf of Aden Environment (Ratified March 1st, 1988);
- Protocol concerning Regional Co-operation in Combating Pollution by Oil and other Harmful Substance in Cases of Emergency (Signed February 14th, 1982);
- Protocol concerning Protected Areas and Wild Fauna and Flora in the Eastern Africa region (Ratified March 1st, 1988);
- Protocol concerning Co-operation on Combating Marine Pollution in cases of Emergency in the Eastern African region (Ratified March 1st, 1988); and
- Convention for the protection, Management and Development of the Marine and Coastal Environment of the Eastern Africa Region (Nairobi Convention) (Ratified March 1st, 1988).